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THE PRINCIPLE OF COOPERATION IN BEHAVIOR

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I

THE object of the present paper is to report briefly some of the data which indicate that groups or species of animals, including man, constitute organismic integrations—that they do not represent a mere collection or agglomeration of individuals. My purpose is to cite some of the biological facts which support the view that the species man, as also species of animals lower in the phylogenetic scale, originally constituted a unified totality in which the activities of the component individuals were throughout motivated by the sovereign principle of behavior inhering in the species as an organismic whole.

In speaking on this subject I am not unaware that I am treading on dangerous ground. The problem in regard to the social integration of mankind is a delicate and much debated one. Herbert Spencer's analogy which regarded human society as an organism made up of individuals, just as the body of the individual is made up of cells, has justly received much criticism from psychologists and sociologists alike. Obviously human societies as they exist to-day are not bound together by cooperative principles such as characterize the interfunctioning parts or organs of the single individual. Spencer's conception was tinged with the sentimental and was not supported by biological evidence. For this reason such concepts as those advanced by Spencer have been dubbed the "group fallacy" and are habitually discredited before they are examined.

Many developments, however, have taken place in the biological and sociological fields since Spencer's time. The biologists have gathered much objective, incontrovertible data on the importance of social interdependence and cooperation throughout animal forms, the ethnologists and anthropologists have stressed the existence of social integrity and of internal coordination in the life of primitive tribes, and the scientific world has in general turned more to the study of functioning wholes, having realized that the part is wrongly conceived and interpreted when studied as an atomistic element isolated from the whole of which it is an integral constituent.

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Among those who have contributed to the development of this trend one thinks especially of Lashley (23) and his students in the field of brain physiology; of Goldstein (17) in the neurological field; of Wertheimer (35), Koffka (19), Köhler (20), and Wheeler (36) in psychology; and of Woodger (39), Bertalanffy (3) and Spemann (33) in genetics and in biology proper. One of the most significant advances toward a new interpretation as regards development and behavior on the physiological or anatomical level has been made by G. E. Coghill (12, 13, 14). Prior to the careful observations of Coghill and his coworkers it was generally accepted that the first reactions of the developing animal in relation to the environment were of the nature of discrete responses of a reflex type, and it was further thought that in the course of the animal's development these reflexes were secondarily integrated with one another, thus insuring coordinated behavior in the organism. Coghill, however, observing chiefly *Amblystoma*, and Minkowski (27) the behavior of the human foetus, have shown that such a view is completely ungrounded in fact. They offer evidence to indicate that the first behavior in the developing organism is of a type that involves the reaction of the organism as a whole, and they show that the discrete, reflex type of response develops secondarily from this total reaction by a process of individuation. Even after the individuation of reflexes has occurred, the total action-pattern retains sovereignty over the partial patterns of the healthy organism. Coghill has further shown that the motor components of the nervous system are completed before its sensory connections have been formed. This indicates that early behavior is spontaneous, that it arises from within the organism and is not called forth by outside stimulation. This investigator has thus brought a formidable challenge to stimulus-response psychology and its various mechanistic concepts.

In psychiatry and sociology the adoption of the newer, more organismic viewpoint has been slower, and the opposition to it more deeply entrenched. The most determined attempt that I know of to bring concepts in these spheres into alignment with the generally changing conceptions in other fields of science has been made by Dr. Trigant Burrow and his associates. In a communication published in *The Journal of the American Medical Association* as early as 1914 Burrow (6) stressed the social nature of the neurosis and the inadequacy and unreliability of psychiatric criteria which classified some individuals as normal and others as neurotic. As a result of submitting the social group itself to a rigid and inclusive analysis, he has in subsequent writings consistently insisted that so-called normal processes, because of their deviation from biologically consistent behavior, stand in as great need of a critical and exhaustive study as do the processes of the obviously neurotic individual. And by normal processes Burrow means the processes of himself, myself, yourself. He does not refer to normality as some vague generality existing in some remotely abstract sphere. In Burrow's organismic view, normal social processes are essentially of one piece with the bizarre behavior of the neurotic patient. The processes in the patient are not alien to or fundamentally different from those processes which habitually receive social credence and corroboration. From the basis of his inquiries, such categories as psychiatrist

and patient, normal and neurotic represent a formulation that is too static and absolutistic to fit into a relativistic view of behavior and its disorders. These conventional categories proved satisfactory only so long as each individual was looked upon as a discrete action-centre without intimate motivational connections with others of his species.

Burrow was thus forced by his experimental investigations of groups to apply an organismic view to human behavior and its disturbances. His position is that originally man as a species represented a unit, a whole, just as a herd of animals or a colony of ants or bees is regarded to-day as a supra-individual complex with emergent properties. The primary basis of motivation for man's behavior had its origin in the species, and this motivation was always in relation to species solidarity. The individual, as a separate motivational unit, was but a conceptual abstraction. As the result of a bio-social *faux pas*, however, the individual has been split off in motivation and feeling from his biological group. He has assumed an arbitrary isolation and individuation which are quite out of agreement with existing biological data. Contrary to our beliefs, our fancies and our cherished suppositions, the individual does not constitute the unit of social motivation and behavior. He no more represents the unit of social behavior than the discrete reflex represents the unit of physiological behavior. The social group, the race or species, is the fundamental unit. The behavior of the individual can only be sane and effective when it is in alignment with this principle. This conception of Dr. Burrow's rests upon firm, biological ground. It possesses in no sense a sentimental, religious or mystical connotation.

II

It will be readily seen that such a change in frame of reference must alter very fundamentally our study and interpretation of behavior. As a matter of fact, Burrow's researches in human behavior must lead to a reorganization of concepts in the field of man's interrelational function in much the same way that Coghill's studies have reorganized earlier views in regard to behavioral development in animals. For in the field of man's interrelational or social organization and behavior, the accepted viewpoint to-day is analogous to that held by neuro-embryologists in regard to the organization of behavior in animals prior to the researches of Coghill. The individual is to-day conventionally looked upon as the primary element, the fundamental unit out of which social units and social behavior are secondarily built. The child at birth is assumed to be filled with anti-social tendencies and to be imbued with instinctive ego-drives which are directed toward self-satisfactions antagonistic to others of his kind. The child is thus conceived of as starting life as a self-centered and socially disruptive unit. As a result of contact with the social group about him—first with his parents and later with the wider social community—these destructive, anti-social trends are either sublimated, repressed or disguised, so that the individual succeeds in getting along with others with a certain degree of external harmony. We hear much, then, about the socialization of the individual. Indeed this function is considered the all-important task of social education.

But we may ask how the data which we have from child psychology fit in with this concept. At the very outset we will probably recall that Piaget's

interpretation of the development of speech in the child is in alignment with this traditional sociological and psychiatric view. Piaget (31) holds that the first type of speech to appear in the child is ego-centric speech. It is speech not in relation to others but in relation to the child himself. The speech of the child is supposed only gradually to lose its ego-centricity and become social speech as a result of impact with the social forces about him. In a recent article, however, Vigotsky (34) furnishes experimental data to support the contrary view, namely, that speech when it first appears in the child is essentially social in nature and becomes more ego-centric as the child grows older. He considers ego-centric speech as a transition from the social activity of the child to his individual functions, from cooperative activity to the child's own individual activity. The latest experimental results and interpretation in regard to the development of speech in children lend no support, then, to the customary conception of the child as an ego-centric and asocial being. On the contrary, these results support the view that the appearance of ego-centric trends in the child is not due to his intrinsic organization, but rather that they are secondarily acquired.

To pass to other evidence from child psychology, Lewin (22) has emphasized that for the child the boundary between the self and the environment is less defined than for the adult and that the 'I' or self is only gradually formed in the second or third year of life. Other investigators have also referred to the surprisingly slow development in the child of the sense of the 'I' or self, and have laid stress upon the fact that one of the most difficult concepts which the child has to master in his early years is the idea of himself as a separate, localized being, or as an individualized totality in himself. This is a particularly striking and interesting finding, especially when we consider the circumstance that from the background of our present culture the child is exposed from birth to the explicit and implicit assumption on the part of parents and the social milieu that the individual self or 'I' represents the unit of social function, that it is a dynamic totality and is only connected superficially with others through the rather secondary and artificial process of socialization. Now, if the child were by his original nature ego-centric and asocial, as the majority of students hold, it is difficult to explain why the concept of the 'I' or self should present such difficulties for him. It would naturally be supposed that, if this were the case, such a concept would be his guiding principle and would be the earliest personality-constellation to make its appearance. The very fact that personalistic concepts appear at a relatively late ontogenetic period in the development of the child lends much support to the view that such concepts are not in alignment with the natural growth processes of the child's organism but are rather in the nature of conditioned responses which are imposed by the child's contact with the world of adults.

In other words, in the course of its development the child does not go through a process of socialization but, quite the contrary, the process is one that more and more renders him asocial. To avoid being misunderstood let me expand this statement somewhat and explain just what I mean. There is no question but that the growing child is trained in the social amenities, the cultural customs and the types of behavior expected of him in different social situations. But my point

is that this training is on a secondary, superficial or conditioned level. It is subsequent and parallel to a process in which there is a weaning of the child from the sense of biological continuity and solidarity with his kind, and the establishment within him of a sense of personal identity, motivation and authority which of its nature must be in conflict with the identity and motivation of others of his social group. Expressed differently, the total social behavioral pattern which is the biological heritage of the human infant, as it is of other animal species, is disrupted, and an undue individuation takes place. This individuation, which in the course of time sets up an autonomous individual with private hopes, desires, wishes, gains and losses, of necessity brings about severe conflict when the desires of two or more elements or individuals happen to interfere with one another. The incentives to behavior have inadvertently become tied up with the individual as an arbitrary centre of action and motivation rather than with the social group as such a centre.

The findings of a number of other investigators give weight to our organismic thesis. Lack of space prohibits more than a very cursory reference to them. Recent observational and experimental studies by Crook (15) and by Alma Frank (16) report that there is a disruption of physiological coordination of function and the appearance of awkward part-responses as the child grows older. As a result of a great deal of experimental work with children in which they were placed in different types of social situations, Charlotte Bühler (4, 5) points out that cooperative behavior among children is more primary than the competitive response in that it much outweighs the latter in the early years of life. Using an experimental situation that would favor the expression of competition, she found that this type of response did not make its appearance until about the third year of life. Gardner and Lois Barclay Murphy (29, 30) have also emphasized the presence in the young child of socially coordinating trends. Such observations will make it increasingly more difficult to adhere to our present psychological and sociological conception of the child as an ego-centric, antisocial being who is welded into the social pattern only by the force of pressure.

III

There are two other fields from which I should like to draw material corroborative of the thesis developed by Burrow. First is the field of anthropology or ethnology. Competent observers of life among primitive peoples have stressed the coordination and social solidarity of these groups, and the remarkable lack of individualism and competition among them. Kropotkin (21) supplies a wealth of material concerning this point. Authorities are in rather general agreement that life among primitive groups is universally based on tribal unity, and that the concept of individualism, as we are familiar with it, is meaningless to them. This seems to be one reason why contact with civilization plays such havoc with primitive peoples. It tends to destroy tribal unity and solidarity. Numerous writers such as Melville (26), Mead (24, 25), Heard (18), Benedict (2) and Rivers (32) have stressed the extent of social integration and cooperation among primitive tribes. Archeologists have also called attention to the fact that in unearthing the burial grounds of early cultures they have found very few implements of a warlike nature. From the background of the findings of these excavations they have come to the conclusion that tribes of early, prehistoric man lived on relatively friendly terms with

one another, and that they were by no means as pugnacious and warlike as are social groups to-day. While I am fully aware that a number of anthropological authorities still adhere to the individualistic viewpoint, it would seem that the more recent anthropological, ethnological and archeological students are in agreement in indicating that unbridled individualism is a modern growth, that it is not characteristic of primitive mankind.

The other general field from which I should like to draw supporting evidence is that of the comparative behavior of animals lower in the evolutionary scale than man. As we know, as early as 1890 Kropotkin (21) stressed the importance of the factor of mutual aid in animal life and gave numerous instances of this principle and its effectiveness in securing the survival of the species. He pointed out that even in his concepts of struggle for existence and survival of the fittest Darwin had consistently stressed the fundamental principle of cooperation in the species.

From his wide observation of animal life Kropotkin gives numerous instances of cooperation, mutual aid and social integration among insects, birds, and mammals. More recently Allee (1), gathering his observations for the most part under controlled experimental conditions, has shown the beneficial effects and the survival value of aggregations in widely divergent animal groups. There is not the opportunity at the moment to cite examples, but I should like to quote a few statements from the summary chapter of Allee's book.

"The potentiality of social life is inherent in living matter, even though its first manifestations are merely those of a slight mutual interdependence, or of an automatic cooperation which finds its first biological expression as a subtle binding link of primitive ecological biocoenoses. . . . Evidently," he says, "mutual interdependence, or automatic cooperation, is sufficiently widespread among the animal kingdom to warrant the conclusion . . . that it ranks as one of the fundamental qualities of animal protoplasm, and probably of protoplasm in general."

Other biologists have also emphasized the fundamental nature of social aggregations among animals. To name but a few, we may mention Wheeler (37, 38), Morgan (28) and Child (10). As a result of his study of plants, Clements (11) insists that the same conceptions are applicable here.

While the observations and insight of these investigators have been unfailingly keen and comprehensive when observing groups made up of animals and of plants, they have seriously faltered where they have attempted to carry over their conclusions to civilized human communities. They have attempted to compare the family, the nation, the church, political parties and other social institutions with such organismic wholes as are represented by animal societies. But it is obvious that such social affiliations are not of the same order. The cooperation and interdependence which we found characteristic of biological foundations are not operative in these sophisticated social groups. Such groups operate from individualistic principles of behavior and not for the good of the community as a whole. Through his finding that man as a social organism is suffering from a racial neurosis Burrow has brought this anomaly in man's social behavior into line with biological data generally. As I have already indicated, he does not use the term neurosis figuratively. He actually means that man as a biological animal is definitely disordered in respect to his social and bionomic adjustment. This conclusion is not one that was lightly arrived at. It resulted from a painstaking and exhaustive analysis of social groups in experimentally controlled situations continuing over a period of fifteen years. As a result of investigating the so-called normal ideas, beliefs, wishes,

emotions, motivations, etc. characteristic of our daily social interchange, it was found that the social reactions of man which are habitually accredited as normal are, from a position of unbiased observation, as distorted and as lacking in biological reality as the isolated responses of the neurotic patient. The normal individual, like the neurotic, was found to be constantly thinking and acting in terms of his individualized self. He has established an image of himself as an isolated unit of behavior with private values, wishes and motivations, and this same image dominates his social interrelations.

The social neurosis, then, goes hand in hand with the undue individualization that has taken place in civilized man. The social institutions which man has constructed are built about his mistaken conception of himself as the essential motivational unit. These institutions, therefore, do not have the synthesis and organismic properties we found characteristic of social groups among animals and plants. In human groups we invariably find that discord, conflict, a blatant sentimentality or an esoteric mysticism are their guiding principles. Such groups are limited in their viewpoint. They have an axe to grind. They are in disharmony, conflict or competition with some other group. But man is still an animal. His biology is his most fundamental and ineradicable property. He has not permanently lost his biological heritage of cooperation and of true social integration. The neurosis, if socially recognized, can be corrected. The overtly individuated element or individual can again be brought under the control of the primary action-centre of the race or species.

IV

In the preceding section I have cited some of the evidence from the fields of child development, comparative psychology and anthropology as it lends substantiation to the conception of social groups as organismic wholes and as it supports the thesis of the social basis of man's consciousness. Psychopathologists will be particularly interested in the implications of the present thesis as they may relate to the neurosis and psychosis. The various writers who have dealt with the problem of nervous and mental disease have agreed that the fundamental characteristic in these conditions is the presence of conflict. This conflict may attach to any number of situations. It may express itself in regard to essential circumstances in the patient's life, or to so seemingly trivial a matter as what necktie to put on. It may find any number of symptomatic expressions: the patient may withdraw from the conflict (regression), he may try to solve it on a substitutive level (sublimation), he may deny it in himself and attempt to place it in his environment (projection), he may seek to have others solve it for him (transference), etc., etc. But the important consideration for us at the moment is that conflict is an invariable feature of all conditions of disordered behavior.

Now conflict within a personality presupposes that the personality has been split into parts and that these parts have of themselves acquired an undue independence in relation to the whole personality structure. The central principle within the personality as a whole has lost its coordinating power in respect to partial components. The components themselves have become motivating powers in their own right and hence no unified course of behavior is possible. Psychopathologists have long recognized such a division in the personality of their patients and have named one of the most baffling of psychoses, schizophrenia or split-personality.

As this particular psychosis is one of the topics on which a number of papers will concentrate at these meetings, I should like to mention schizophrenia at least tentatively in indicating the possible bearing of social division and conflict upon psychopathological conditions.

I should indicate at this point that Burrow (8, 9) has emphasized the fact that, concomitantly with the partialization that has inadvertently separated the individuals of the race, there has inevitably occurred a partializing effect within the individual himself. Space does not permit a discussion of this partialization which has occurred within the individual, but perhaps I may say that there is much evidence to indicate that there has been an undue division and restriction in two of the most vital fields of the organism's activity. These fields are those of nutrition and of sex and have to do with the survival of the individual and of the species respectively. In these two physiologically, biologically, psychologically and sociologically primary fields of activation and response, the weight of evidence seems to indicate that the integrity of the reaction of man's organism as a whole has to a large extent been vicariously supplanted by partial reaction tendencies.

We have already considered the fact that from the viewpoint of biological data there is much evidence to support the thesis that man, with his present mental convictions in regard to the independence and supremacy of the element (the individual) in relation to the whole (the race or species), represents an evolutionary anomaly of development. We have seen indications that such a position is not in harmony with biological data, and that evolution could hardly have proceeded at all if lower forms of life had assumed this arbitrary attitude. We have found much evidence that cooperation is a fundamental property of protoplasm itself and have seen examples of its effectiveness throughout the animal scale. We saw that it was very difficult for the child to delimit his personality, that one of the most difficult concepts for him to acquire in early life was that of being an individual "self," separate and distinct from others. Accompanying the artificial separation of the individual from the race or species, there has been a cleavage in the various physiological systems in relation to the organism as a whole (digestive, reproductive) so that they no longer work in harmonious interfunctioning. At the same time we have seen that there has been a cleavage in behavioral trends, so that conflict, indecision, and their compensatory mechanisms, are rather characteristic of the so-called normal personality.

In the schizophrenic personality, this cleavage in behavioral trends has advanced to such a stage that coordinated activity is precluded, and the individual is no longer able to get along in his environment. There is at times a rather complete withdrawal of contact with regard to stimuli and reactions relating to situations outside the individual, and a concentration on a fanciful world within. This regression is usually looked upon as an escape from a painful reality which the personality is not strong enough to deal with, and a consequent capitulation to a system of subjective phantasy in which the patient can make of his world what he pleases. Such regressions are thought of as due to a diseased or faulty personality resulting from hereditary weakness, developmental trauma or from a deep-seated habit disorganization. There is evidence, however, for the view that these severe personality disturbances and extreme regressions represent an inability to assimilate

socially prevalent modes of thinking and feeling which from an organismic basis are themselves dissociated and pathological.

We know, of course, that community medical hygiene was a very important factor in eliminating the dread epidemics which before the rise of scientific medicine swept human communities. We have need to recognize that community mental hygiene is no less important in dealing with those behavioral disturbances which fill our asylums to-day and which, in the form of crime, war, religious discord, political and economic inequalities, etc. represent socio-pathological processes which are equally epidemic. But if mental hygiene is really to be effective, we must envisage it in a more intimate, inclusive, less projective manner. I think we shall find that, along with Burrow, we must come to the practical realization that our own daily, normal processes of interchange are partitive and disordered in a very real sense and that we must thus meet the vital social challenge of replacing our partial, ego-centric views, responses and habituations with principles and behavior that are more in line with man's fundamental phylo-biological motivation.

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MAN: A CONSTITUTIONAL INVESTIGATION (*Concluded*)

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IV. THE METHODOLOGY OF CONSTITUTIONAL INVESTIGATION

A BRIEF consideration should be given to the methods and techniques by which investigators have dealt scientifically with the various aspects of constitution. In general, one may distinguish between the *techniques* of study (i.e. the tools used), and the *methods of approach, or classification*, employed for the better understanding of relationships.

A. Morphological

1. Techniques

Morphological techniques employed have been observational judgments and measurements. Standard anthropometric measurements are best used, as classically described and defined by Martin (188). In the work of recent years of many authors an important aid to accurate evaluation of the morphology of an individual has been the employment of scientific photography. Usually the individual studied is photographed, preferably nude, at a standard fixed distance from the camera (with a long-focus lens) in three views, front, back, and profile. Sometimes additional closer views are taken of the head alone. This subject has been discussed by Pearl, Sutton, Howard, and Rioch (225).

2. Methods of approach

Evaluations of the variations of human morphology may fall into three general categories: somascopic, somametric, and scopometric (a term suggested by Cabot (47)).

a. Somascopic

The term "somascopic" or "anthroposcopic" has been applied to purely observational classifications of morphologic types. Popular conceptions rest on unorganized groupings of this kind. Since it is so subjective and hard to handle statistically, it was not until di Giovanni introduced anthropometry into the determination of physical types that one could say that the scientific study of constitutional types had begun. Though the ideal would be to put correlations of mind and body on a single rational basis, this is not quite possible at the present time and subjective observation must remain as the subsidiary tool of the researcher, frequently pointing the way to further research. That the somascopic method can rise to great heights is illustrated by Thomas Addison's classic description of pernicious anemia (2). At the time, eighty years ago, when he described the form, skin and subcutaneous tissue of persons with the disease, it was believed he was describing effects. But it is now felt that Addison was really describing, except for the pallor, not the results of the disease, but rather a constitutional type which predisposes the individual to it.

The Frenchmen Sigaud (277), MacAuliffe (185) and Thoöris (301) have utilized the somascopic method to a considerable extent. Their form types, the *Respiratoire*, *Digestif*, *Musculaire*, and *Cérébral*, were inspired by a somewhat similar classification made in 1821 by de Troisvèvre (67), a pupil of Halle. According

to Sigaud (277), the *muscular* type has a strongly developed musculature, round head, broad shoulders and large chest; the *digestive* type has a small nose, which is depressed at the base, a large mouth, broad lower jaw, and large abdomen; the *respiratory* type has a broad nose and large chest; and the *cerebral* type has a large head, narrow shoulders and chest, and long narrow fingers.

When Kretschmer (158, pp. 9–10) described his method for studying constitution and psychoses, he began by decrying the isolated observations of medical practitioners of the past, and the belletristic observations of a physiognomical nature. He stresses the need for exact science. Yet his method must be placed in the category of somascopic methods because his data, though fairly thorough, include few measurements (and no indices.)

> Everything depends on a complete, artistic, and sure schooling of our eyes, for a scholarly list of single measurements without any idea or intuition of the general structure will not bring us much further. The tape measure sees nothing; it never leads us to a grasp of the biological types which are our object.

To many such a credo is rank heresy, yet it was by such methods that Kretschmer was able to indicate much which calipers merely verified. Indeed, he regarded anthropometric measurements as merely more exact formulations of what could be ascertained from scientific observation.

Mayer-Gross (193), influenced by Kretschmer, expresses a total distrust of the exact methods of anthropometry for ascertaining morphological types in psychiatry, but he fails to understand that physiognomic expression is one thing and measurable morphology another.

b. Somametric

Recognizing the advantage to the scientific study of body types that is obtained with metric methods, many investigators have now adopted techniques which employ measurements and indices solely. These may be termed "somametric" or anthropometric. As early as 1654 Elsholzius (77) at the University of Padua had devised an anthropometric technique to be used in the clinic. Curiously enough after two centuries had passed another professor of medicine in the same university adopted modern anthropometric techniques, for di Giovanni (68) may be considered to have really introduced clinical anthropometry.

For purposes of discussion, somametric techniques may be divided into those stressing either measurements or indices. Absolute measurements rarely or never are satisfactory in themselves, and it is one of the weaknesses of Kretschmer's work that when he did depart from somascopic methods he utilized measurements without indices. For absolute dimensions can never adequately express proportions.

Indices themselves are of two kinds, depending on the use to which they are put—to express relative proportions of physical features or to express in themselves the whole morphological make-up. Anthropologists are responsible chiefly for the development of the former type of index. Indices of this type can, if of sufficient variety and number, combine to give a very accurate description of an individual or a group. They have been put to great use, being employed extensively by Draper (69, 71) in describing his disease types.

In order to simplify the handling of statistical data on morphological types, to avoid the subjective factor in judgment, and to arrive at a clear definition of categories, various indices of constitution have been devised. Some of the best known are listed in Table 1.

TABLE 1

Selected constitutional indices

1. Andreew (modified by Westphal and Strauss) (330, p. 247): $\frac{(\text{chest circ.} + \text{abd. circ.}) - (\text{arm l.} + \text{leg l.})}{\text{transv. chest diam.} \times \text{sag. chest diam.}} \times 100$
2. Bornhardt (39, p. 108): $\frac{\text{stature} \times \text{chest circ.}}{\text{weight}}$
3. Bouchard (299, p. 484): $\frac{\text{weight}}{\text{height}}$ or $\frac{\sqrt{\text{weight}}}{\text{height}} \times 100$
4. Brugsch (43, p. 47): $\text{chest circ./stature} \times 100$
5. Buffon (217a, p. 51): $\frac{\text{weight (gm.)}}{\text{stature (cm.)}^3} \times 100$
6. Davenport (62, p. 26): $\frac{\text{weight (lbs.)}}{\text{stature}^2\text{ (in.)}} \times 1000$ or $\frac{\text{weight (gms.)}}{\text{stature}^2\text{ (cm.)}}$
7. Florschütz (189, p. 620): $\frac{\text{stature}}{2 \text{ abd. circ.} - \text{stature}}$
8. Klineberg-Asch-Block (152, p. 172): $\frac{\text{stature}^2}{\text{sitting height} \times \text{weight}}$
9. Kretschmer (41, p. 233): $\frac{\text{shoulder br.}}{\text{chest circ.}} \times 100$
10. Kühnel (165, p. 543): $\frac{\text{transv. chest diam.} \times \text{sag. chest diam.} \times \text{ant. trunk ht.}}{100}$
11. Lenhoff (189, p. 620): $\frac{\text{ant. trunk height}}{\text{abd. circ.}} \times 100$
12. Livi (176, p. 130): $\frac{\sqrt[3]{\text{weight}}}{\text{stature}} \times 100$
13. Lucas-Pryor (181, p. 1129): $\frac{\text{bi-iliac br.}}{\text{stature}} \times 1000$
14. Manouvrier (187, p. 64): $\frac{(\text{femur l.} + \text{tibia l.})}{\text{trunk length}} \times 100$
15. Marburg "A" (modified by Westphal and Hartner) (329, p. 424): $\frac{\text{head ht.} \times \text{hand br.} \times \text{shldr. br.} \times \text{chest circ.}}{1000}$
16. Marburg "B" (modified by Westphal and Strauss) (330, p. 245): $\frac{\text{leg length} \times 10{,}000}{\text{transv. chest diam.} \times \text{sag. chest diam.} \times \text{ant. trunk ht.} \times \text{shldr. br.}}$
17. Marburg "C" (modified by Westphal and Strauss) (330, p. 246): $\frac{\text{transv. chest diam.} \times \text{sag. chest diam.} \times \text{biacromial breadth}}{\text{bi-iliac crest br.} + \text{bitrochanteric breadth}}$
18. Martin (188, p. 174): $\frac{\text{bicristal br.}}{\text{shoulder br.}}$ and $\frac{\text{bitrochanteric br.}}{\text{shoulder br.}}$
19. Martinet (123, p. 688): $\text{stature/transv. chest diam.}$
20. Mohr-Gundlach (200, p. 127): $\frac{\text{chest circ.} + \text{abd. circ.} + \text{hip circ.} + \text{weight}}{\text{stature}}$
21. Pearl (221, p. 684): $\text{cylindrical body vol.} = 0.07958 \text{ (chest circ.)}^2 \times \text{stature}$
22. Pignet (235, p. 373): $\text{stature (cm.)} - [\text{chest circ. (cm.)} + \text{weight (Kg.)}]$
23. Pignet-Ver Vaeck (299, p. 497): $\frac{\text{weight} + \text{chest circ.}}{\text{stature}} \times 100$
24. Plattner (236, pp. 382–383): $\frac{\text{transv. chest diam.} \times \text{sag. chest diam.} \times \text{ant. trunk ht.}}{\text{stature}^3} \times 1000$

TABLE 1—*Continued*

25. Quetelet (188, p. 175):	weight/stature
26. Quetelet-Gould-Kaup (146, p. 204):	$\text{weight}/\text{stature}^2$
27. Rohrer (248, p. 851):	$\frac{\text{weight}}{\text{stature} \times \text{shoulder breadth} \times \text{thoracic depth}} \times 100$
28. Stockholm (S_1) (332, pp. 672–681):	$\frac{\text{sternal height}}{\text{transv. chest diam.} + \text{sag. chest diam.} + \text{shldr. br.}} \times 100$
29. Viola (55, p. 33):	Trunk Index/Limbs Index

Trunk Index—(transv. chest diam. × sag. chest diam. × sternal length) + (transv. hypochondriac diam. × ant.-post. hypochondriac diam. × xiphoid-epigastric length) + (bi-iliac diam. × ant.-post. hypochondriac diam. × pubic-epigastric length).

Limbs Index—arm length to wrist + leg length to malleolus

30. von Rohden (299, p. 498):	$\frac{\text{symphysis height}}{\text{chest circ.} \times \text{ant. trunk ht.}} \times 100$
31. Wertheimer-Hesketh (327, p. 41):	$\frac{\text{leg length} \times 1000}{\text{transv. chest diam.} \times \text{sag. chest diam.} \times \text{trunk ht.}} \times 100$
32. Wigert (332, pp. 667–684):	$\frac{\text{shoulder breadth}}{\text{transv. chest diam.} + \text{sag. chest diam.}} \times 100$
33. Wigert (332, pp. 667–684):	$\frac{\text{bicristal br.} + \text{bitrochanteric br.}}{\text{shoulder breadth}}$

Some of these indices have been employed by themselves to express constitution. However, it has been seen that it is not adequate, or it is not possible, to attempt a single criterion of constitution. It must be remembered that constitution is a pattern made up of many constituent parts, and the single index fails to express this.

Ciocco (55) has subjected constitutional indices to careful criticism and warns against putting too much faith in them. He sets down as the requirements of a good index that it must be simple, clear and significant. But in addition it must be definitely correlated with (1) the external morphologic conformation and (2) the internal anatomic structure. An index such as weight/height tells little regarding the first, for while it is true that weight is highly correlated with the horizontal dimensions and stature with the vertical ones, this index is of little use in going outside the limits of the intermediate euplastic habitus. Indices also usually fail to meet the second requirement—the expression of anatomical relationship and variations. For instance, the chest girth/stature index may be the same for two individuals because the actual measurements may be the same, yet one may have a normally flat chest and the other an emphysematous chest. Moreover, an index does not express the relative values to be given to the adipose and muscular development, which may differ in individuals of the same skeletal habitus. McCloy (195, 196) has given these difficulties very careful consideration.

Benedetti (25) expresses dissatisfaction with all indices except Viola's trunk index/limbs index.

Hauchmann (123), in making an evaluation of indices, calculated the degree of correlation between the body build as determined by somascopic techniques and the results obtained through the application of indices. He found that Pignet's index (see Table 1) came closest to expressing morphological structure ($r = -0.76$). Ciocco (55) insists that it is

nevertheless impossible to give a rational statement of the precise physical meaning of a particular value of the Pignet index, whereas Benedetti (25) raises the suspicion that Hauchmann may have made false correlations in obtaining his results.

Implied in most work with single indices is the assumption that there is an ideal average. This is an untenable supposition. It is probably impossible to define accurately the "normal type," which is not to be confused with the "average" or the "ideal." Just as the average of many measurements is no indication of normality, neither is the average of several indices.

In conclusion, while biometric figures are useful guides, one cannot, as Petersen (230) expresses it, "make a constitutional classification solely on the basis of mathematics." The whole nature of constitution would be misunderstood without a realization of the fact that an index cannot fully express the interrelated nature of constitution—a sort of spider web with many constituent parts.

c. Scopometric

Midway between such extremists as Török, a Hungarian who took five thousand measurements on the skull alone, and Sergi (269), who once proposed that measurements be entirely done away with and only observations used, lie the majority of modern students of body build. Their method may be called "scopometric," or a combination of somascopic and somametric techniques. Racial anthropology has found it extremely valuable to employ careful observations along with measurements; even though its objectives are different from those of constitutional studies—one may not properly speak of "disease races"—this conjunction of techniques has its applicability in constitutional investigation.

It is to be noted that when scopometric diagnosis is employed investigators place relatively less reliance on data procured by observations. For example, although Hooton (134) utilizes a few dozen types of observation in describing the 17,000 subjects of his criminal study, he uses indices alone in his analysis of body build.

3. Methods of classification

Aside from the techniques of gathering data there is the important problem of how the material shall be handled for classifying the various types of habitus. It will be instructive to observe the manner in which various investigators have tried to establish categories of body build, especially when dealing with the relation of morphology to disease.

Some have created more or less arbitrary somatic types and then have cast about to see what diseases seem to characterize them. This method has been employed by Viola (309) (megalosplanchnic and microsplanchnic types), Sigaud (277) (respiratory, muscular, cerebral, and digestive types) and Kretschmer (158) (asthenic, athletic, pyknic, and dysplastic types). It is to the advantage of this method that it utilizes but a few categories and is easily applicable in the clinic. However, few individuals fit such categories perfectly, for the great mass of people are not well differentiated and are usually found to be intermediate. From earliest times men have been disposed to favor this manner of classification, but its advantage of simplicity has been vitiated by the difficulty of handling it statistically. A similar tendency to simplify, with bipartite classifications, is seen in the physiological differentiation between vagotonia and sympatheticotonia, and the psychological differentiation between schizothymia and cyclothymia, between schizophrenia and the cyclic psychoses.

Some justification for this type of division is apparent in the tabulation of data. If all individuals were geometrically alike, then body weight would vary directly as the cube of height, for height is a linear dimension and weight, or mass, a cubic one. When actual height-weight tables are examined this is seen not to be so. Such a table has been prepared by Kaup (146, p. 218) in *Biologie der Person* (44, I.), and it can readily be seen here that there is a discrepancy between the actual weights and the theoretical ones (cf. Table 2). Such figures demonstrate that human beings are not free to vary in all directions; as the result of such a limitation the average short man must be regarded as a different geometrical type from the average tall man. (See also section II. E. 3 for other discussion of height-weight relationships.)

TABLE 2

Comparison of actual and theoretical weights

AUTHORITY	LENGTH CLASSES			PERCENTAGE DIFFERENCE 12.5%
	160 cms.	170 cms.	180 cms.	
Schweinig	60.2 kg.	66.6 kg.	74.3 kg.	23.4%
Brugsch	59.3 kg.		71.0 kg.	20.0%
Rautmann	58.3 kg.		71.9 kg.	23.0%
Theoretical Weight	60.0 kg.	70.0 kg.	85.4 kg.	40.0%

How can such a limitation be explained? One could speculate that far back in human history there were two distinct geometric types of races and that in the mixture of these ancient stocks clean cut types have been lost, but sometimes tend to reappear. Or one might maintain that a process of natural selection is at work—individuals who are tall must find it a great advantage to have a body-surface/weight ratio below the theoretical normal, for heat is lost from the surface and the greater the surface the higher must be the metabolism. The possibility is also suggested that perhaps when an individual has one characteristic which deviates from the average, other characteristics in the germ plasm may be linked with this and cause a greater deviation.

Another philosophic form of speculation, from an evolutionary point of view more broad and more vague than the ontogenetic or even the phylo-genetic, may be worth considering briefly. Life in its simplest form, as now known, probably originated as a cell nearly spherical in form, with the greatest conservation of mass to surface area. This probably served for protection of the individual when motion was not as necessary as self-preservation. But there probably came a period when motility was of greater importance. While a sphere can roll, in doing so it is at the mercy of its environment; to exercise greater control of such motility an evolution of form must take place. Very possibly the hypothetical primordial biological sphere became roughly elliptoid, cylindrical, or even developed rectangular or block-like projections. So may have been introduced primary elements of greater ruggedness, possible *anlage* of systems of locomotion. If such an evolutionary trend is carried farther, mass shrinks rapidly in proportion to linearity, and, carried to a logical but extreme conclusion, one might expect some form approaching a pole or a rod,

or even an hypothetical straight line, having only one dimension—but survival value would be lost somewhere along such an evolutionary road.

Perhaps it is not too fantastic to draw parallels between such hypothetical primitive forms and different kinds, sizes, and shapes of man himself. Man must locomote, and has extremities for this purpose. Man's head protrudes, too, the better to enable him to control his environment. Aside from extremities and head, however, he may be considered roughly cylindrical in form. The cylinders of some individuals definitely approach the sphere in shape; in others a blocky cylinder or rectangle or block; and in still others go a long way toward the lack of sufficient material substance to maintain life. It is small wonder that these latter, the leptosomes or asthenics, have been called by some the "hyperevolute."

But such philosophic speculations and explanations are idle and without scientific value, and are offered here as no more than food for thought.

Another method of morphological classification, quite as arbitrary as the one already discussed, bases its categories on extreme types of habitus—dysendocrine types, progeria, the diatheses, status lymphaticus, and various pathological groups. The method is satisfactory within its obvious limits: it has applicability only for extreme types. Moreover, the groups so formed are not equally pure; and there is no discrimination between those with disease and no disease. The technique does, however, give some good leads, for it shows that within the general population many individuals do belong to such extreme types who otherwise would not be well differentiated. (It is true that some of these types always appear in relatively pure form, e.g. mongolian idiots.) Little is known of the nature or origin of such types.

There is still another method of classification, that of the physical anthropologist. In combining the two above methods it has proven more satisfactory than either. Data is gathered on a group of individuals who, it is suspected, correlate with the category under investigation, and this group is compared with another similarly treated to determine if there is a significant difference. In this way anthropologists have been able to establish descriptions of races, growth changes, sex differences, etc. This method, for example, has been used by Draper. Data secured on patients is separated according to disease groups and the classifications so created compared with one another in order to see if significant differences are apparent. A variant on this technique is to gather data on as large a group as is pertinent to the study, segregate those individuals which tend to cluster about certain types, and then determine if such types correlate with whatever category one may be investigating.

Temporarily such methods may have great value. But when valid systems of morphological classification and norms shall have been worked out *for the entire population* it would seem the more logical procedure to compare given groups with such norms, rather than employ intergroup comparisons.

B. Physiological—Techniques and methods

The methodology of investigation in the physiological aspect of constitution is much less well organized than in the morphological. In general the techniques are those developed by the biological scientists, chiefly the biochemists, the physiologists and the clinicians, and the physiological characters studied are fragments of the total individuality without

much systematic classification. These fragments individually are not without their significance but generally they are so minute that the significance of each is hard to discern.

The hope of the future in this field lies in endocrinology, as the Italian school has pointed out. As simpler and more accurate methods for studying endocrine physiology are evolved it may be possible to elaborate a classification of constitutional physiology that will at once be comprehensive, be easily correlatable with both morphology and psychology, and serve as the skeleton onto which to fit the soft parts of the more detailed physiology now studied almost exclusively.

Lacking such a schema at the present time, it is still well to mention the chief methods of evaluating physiological differences. Day (64) has compiled a very complete list. It is unfortunate that this phase of biological investigation has emphasized too exclusively the establishment of standards to the comparative neglect of possible laws governing the variations of individuals from such standards—i.e., statistically speaking, emphasis has been on determining the mean at the expense of the standard deviation.

Pende (228, pp. 65–74), in discussing his study of the "dynamic-humoral criterion" of constitution (his term for the equivalent of the physiological aspect), lists and describes the following useful techniques: basal metabolic rate determinations; determination of the specific dynamic action of food; study of glycemia and carbohydrate tolerance; a physiological anamnesis to determine the stability of the autonomic nervous system; pharmacodynamic tests with epinephrine, pilocarpine, eserine, atropine, histamine, insulin and ergotamine; certain special reflexes as the oculo-cardiac reflex, the pilomotor reflex, and certain pupillary reflexes; and reactions of the skin to light scratching (dermographia) and to intracutaneous injections of numerous chemicals.

Study of the electrocardiogram and of the spirogram have also been employed, and the detection and study of electric currents in other parts of the body may hold considerable promise.

C. Pathological—Techniques and methods

The methodology of the pathological aspect of constitution is that of the clinician and the pathologist, and is so well known as not here to need description. Organization and classification of pathological observations along taxonomic lines is, as in the case of constitutional physiology, somewhat fragmentary and inadequate, although the most careful workers in this field seek constantly to keep the integrated individual, and not simply his pathological parts or organ systems, as the prime consideration. The total list of possible pathological ailments afflicting man today recognized as clinical entities or pathological conditions runs into the thousands, and fills 600 pages of fairly fine print in the *Standard Classified Nomenclature of Disease* (286). Such diagnoses are to be considered the sound basis for the correlative study of pathology in constitution, at the present time.

D. Psychological—Techniques and Methods

The methodology used in the recognition of personality types is not to be confused with that of determining morphological types, earlier discussed.

Personality types may be diagnosed in the following ways (47), technologically and methodologically:

(1) The clinical diagnosis of psychoses (e.g., schizophrenia and manic-depressive psychoses).

(2) The diagnosis of personality types by means of autodiagnosis, where the subject answers questions

presented either during the interview or when expected in response to a paper and pencil test.

(3) The diagnosis of personality types by means of observation of behavior.

(4) The diagnosis of personality types by means of a combination of any of the preceding methods.

Most of the work in the field of psychology stems from the two pathologic types of the psychiatrists first delineated by Kraepelin—schizophrenia and the manic-depressive psychoses. Utilizing these clinical categories, Kretschmer (159) came to the conclusion that even normal personalities could be correspondingly dichotomized into schizothymes and cyclothymes, associated respectively with the asthenic and the pyknic habitus, as in the case of the psychoses. Few of the investigations into the psychological aspect of constitution are concerned with anything else than an attempt to verify or discredit Kretschmer. For this reason resulting psychological classifications are intimately interwoven with morphological types, attempting correlations by what has been called "experimental clinical diagnosis." The chief subjects of inquiry along this line have been in the psycho-motor responses, physiological functions, color reactions, psycho-galvanic reflexes, school ability, handwriting, and stuttering.

The chief criticism of the majority of such investigations has been the fact that very seldom has data been accumulated on relatively normal individuals; the subjects have usually been institutional or clinical cases.

Draper (71) has expressed great faith in the psychoanalytic approach to the understanding of the psychological background of the individual, saying that "the methods which have proved most valuable at the Constitution Clinic not only as therapeutic forces but for the purpose of research have been those of free association and the dream."

Intelligence is also studied, and the methodology of the study of this part of the psychological aspect is well known, the Stanford-Binet Test being the standard. Various other tests have been devised to study various intelligences, such as the mechanical aptitude test, the rapid reading test, word association tests, color fusion tests, perception span tests, etc.

V. RESULTS OF RESEARCH

A. Morphology

1. Systems of classification

It is a curious and perhaps significant fact that 2500 years ago Hippocrates (129) said that there are two roots of human beings, the long thins and the short thicks. Almost all simple classifications of type since that time have nearly the same basis, despite variety of nomenclature and detail of description. Even in the world of insects has such a distinction been made, especially in the delightful essay by Wheeler on the *Physiognomy of Insects* (331). The slender type of human has been variously called the leptosome, the longitudinal, the linear, the asthenic, and the dolichomorphic; the broad type has been called the plethoric, the apoplectic, the pyknic, the gouty, the *arthritismus*, the round type, and the brachymorphic. This bi-polar grouping is useful for its simplicity and has been described in detail by Stockard (294, 295). Hackel (117) has summarized the various methods of classification that have been employed. A comparative tabulation of the many systems that have been used is given in Table 3.

Careful inspection of this table is warranted. It is obvious that the various systems represent different, but only slightly different, approaches to the problem of human morphology taxonomy. Some are primarily morphological, others include physiological properties inferen-

TABLE 3. *Classifications of constitutional types*
(Adapted from MacAuliffe (185), Wertheimer and Hesketh (327), Cabot (47), McCloy (195), and Klineberg (151))

SOURCE	NATIONALITY	1	2	3a*	3	3b*
Hippocrates (460–400 B.C.)	Greek	Habitus apoplecticus (short, thick)		Habitus phthisicus (long, thin)		
de Haller (1750)	Swiss	———	Athletic		———	
Halle (1797)	French	Abdominal	Muscular	Thoracic		Nervous, cephalic
Cabanis (1802)	French	———	Muscular	———		Nervous
de Troisvèvre (1821)	French	Abdominal	———	Thoracic		Cranial
Rostan (1828)	French	Digestive	Muscular	Respiratory		Cerebral
Walker (1852)	Engl.	Nutritive beauty (Venus)	Locomotive beauty (Diana)	———		Mental beauty—(Minerva)
Carus (1853)	German	Phlegmatic (Plethoric venous)	Athletic	Asthenic		Cerebral
di Giovanni (1877)	Ital.	Third combination	Second combination (Plethoric)	First combination (Phthisic)		
Beneke (1878)	German	Rachitic	Carcinomatous	Scrofulous, phthisical		
Beneke-Rokitansky (1878)	German	Hyperplastic	Normal	Hypoplastic		
Huter (1880)	German	Ernährungstypus	Krafttypus	Empfindungstypus		
Manouvrier (1902)	French	Brachyskeletal (Micro-skeletal)	Mesoskeletal	Macroskeletal		
Stratz (1904)	German	Xantodermic (Racial)	Leucodermic (Racial)	Melanodermic (Racial)		
Virenius (1904)	Russ.	Connective	Muscular	Epithelial		Nervous
Stiller (1907)	German	———	Hypertonic, apoplectic	Atonic, Asthenic		
Sigaud (1908)	French	Digestive	Muscular	Respiratory		Cerebral
Bean (1912)	Amer.	Hypo-onto-morph (Hypo-phylo-morph)	Meso-onto-morph (Meso-phylo-morph)	Hyper-onto-morph (Hyper-phylo-morph)		
Tandler (1913)	German	———	Hypertonic	Hypotonic		
Bryant (1915)	Amer.	Herbivorous	Mesoplastic (Normal)	Carnivorous		
Goldthwaite (1915)	Amer.	Herbivorous	Mesoplastic (Normal)	Carnivorous		
Mills (1917)	Amer.	Hypersthenic	Sthenic	Asthenic (Hyposthenic)		
Brugsch (1918)	German	Wide chested	Normal chested	Narrow chested (Asthmatic)		
Viola (1919)	Ital.	Megalosplanchnic (Macrosplanchnic)	Normosplanchnic	Microsplanchnic		
Davenport (1923)	Amer.	Fleshy biotype	Medium biotype	Slender biotype		
Stockard (1923)	Amer.	Lateral	Intermediate (Normal)	Linear		
Aschner (1924)	German	Broad	Normal	Slender		
Bauer, J. (1924)	Austr.	Hypersthenic habitus (Arthritic habitus)	Sthenic habitus	Asthenic habitus		
Bounak (1924)	Russ.	Euryplastic	———	Stenoplastic		
Draper (1925)	Amer.	Gall-bladder	———	Ulcer		
Kretschmer (1925)	German	Pyknic	Athletic	Leptosome (Asthenic)		
MacAuliffe (1925)	French	Round	———	Flat		
Weidenreich (1926)	German	Eurysome	———	Leptosome		
Pende (1927)	Ital.	Hypervegetative	———	Hypovegetative		
von Rohden (1928)	German	Endodermic	Mesodermic	Ectodermic		
Sheldon (1939)	Amer.	Endomorphic (Pykno-, trypherosomic)	Mesomorphic (Somatosomic)	Ectomorphic (Leptosomic)		

* These two classifications are by many authors listed separately, making a total of four or more classifications, but they seem to be only slightly

tially related to morphological variants. Indeed the approaches are so varied that it scarcely seems logical to compare the different schemata, on first glance. As Wertheimer and Hesketh have said (327, p. 9):

> . . . it may appear inappropriate, or even unjust, to chart side by side the classical traditional types of Hippocrates, the romantic-symbolic system of Carus, the esthetic mythological analogies of the English anthropologist Walker, the dogmatic pathological "combinations" of di Giovanni, and the clinical anthropometric findings of Manouvrier, Viola, Brugsch, and Davenport, the brilliant intuitive divisions of Sigaud and his pupils which have been put to clinical use by Julius Bauer, the pathological-anatomical observations of Rokitansky, Beneke and Kundrat, the anatomical types of Mills and Stockard, and the careful clinical descriptions of the psychiatrist Kretschmer.

The striking conclusion is that despite this diversity of methodology there are certain clearly recognizable and generally agreed upon elementary variations in human morphology. Korányi (155) states, after a careful and thorough review of the major approaches to the methodology of the study of constitution: ". . . the foregoing attempts to distinguish various types of men, from widely different points of view, lead always to approximately the same results," and concludes deductively that there must be a highly reasonable validity in the major classificatory systems distilled from these men's observations.

It is true that the complexity of the problem baffled some workers. Stockard (295) reduced all variations to a bi-polar distribution, mentioning only briefly the "intermediates" or "normals." This same general schema is also adopted by Manouvrier (187), Bryant (45), J. E. Goldthwait (103), Kugelman (164), and Bean (22). Rautmann (240, 241, 242, 243), too, has studied the inter-relations of the body in its various parts and has worked out a fairly simple classification.

Such a bipolar oversimplification has a certain statistical validity. If any single criterion is used to differentiate variations from the mean, it is found that individuals fall into a distribution pattern approximating the bell-shaped curve of "normal" distribution. This is well known by all biometricians, and is discussed simply and adequately by Harris (122). McCloy (195, p. 22) points out that whatever index is used to determine body build the result is such a distribution. In the present state of inexactitude and confusion it is perhaps not unnatural that the emphasis should be placed primarily on the two extremes and reference be made to all others as "intermediate," as Pearl and Ciocco (54, 221) have done in their otherwise excellent study of body build in relation to disease.

Some workers have gone so far in this reinterpretation that they seem to have overlooked original definitions and descriptions. Pearl (221), for example, has placed Kretschmer's "athletic type" in a position intermediate between his "leptosome" and his "pyknic," largely on the grounds of statistical necessity. A careful perusal of the descriptions of the "types" of certain authors, however, as of Rostan (251), Sigaud (277), and especially Kretschmer (158) suggests the recognition of a *third major variant*, i.e., a deviation from the mean in a third dimension, in addition to the two most easily recognizable forms, the very linear and the very lateral. This third element is the very stocky and muscular as distinguishable from the "pyknic."

It is true that even Kretschmer, who has among recent writers contributed most to the recognition of this third variant, is confused in his distinctions between

Sheldon (1939) | Amer. | Endomorphic (Pykno-, trypherosomic) | Mesomorphic (Somatosomic) | Ectomorphic (Leptosomic)
* These two classifications are by many authors listed separately, making a total of four or more classifications, but they seem to be only slightly

his "athletic" and his "pyknic" types. This general confusion seems to arise from the general failure to observe that at the end of the distribution (according, e.g., to a height-weight relationship criterion) opposite to the slender there are two fundamentally different kinds of "laterals"— the very heavy due to a relatively high degree of development of deposits of fat, and the very heavy due to a relatively high degree of development of the musculo-skeletal elements of the body. Toward the other end of the distribution, there is also confusion between the basic morphological elements of the asthenic and the athletic types. Caroli and Corman (49) examine this confusion carefully and distinguish with considerable success between length *per se* and gracility or slenderness (*grêle*), and note Kretschmer's changed terminology in his later writings, in which he replaces the less meaningful term "asthenic" with the more accurate and expressive term "leptosome" (= delicate-bodied). The same confusion is reflected by McCloy (195, p. 19), who makes the statement that "the linear type in general has a larger musculature proportionate to his vegetative or visceral parts."

Von Rohden (317), in a study of psychoses (see section V. D. 2. b.), uses as his basic morphological classification the trichotomous system of Huter (139), formulated about 1880. This divided people into three groups or types: cerebral (*empfindungstypus*), muscular (*krafttypus*), and digestive (*ernährungstypus*), with ectodermic structures (skin and central nervous system) predominating in the first case, mesodermic structures (chiefly bones and muscles) in the second, and endodermic (digestive apparatus) in the third. This is remarkably similar to Kretschmer's basic classification, and Kretschmer may have been influenced by Huter's descriptions, although he does not refer to him in his book (158). Von Rohden (317) employs this basic classification in his study and finds schizophrenics to be predominently ectodermic, or leptosomic; epileptics predominantly mesodermic, or athletic; and manic-depressives predominantly endodermic, or pyknic (see section V. D.). This work of von Rohden's seems carefully done and important, except that it seems to give an unusually high percentage of leptosomics (ectodermics) in the "normal" population, and this casts some doubt upon the validity of his classification.

Saltykow (254), employing certain anthropometric measurements, observes five different elements—asthenic, gracile, fibrous, pyknic, adipose—among individuals, and classifies them according to various combinations of these elements.

The clearest description of and distinction between the three almost universally recognized elements or components of the body seems to have been made by Sheldon (274). Sheldon has made three unique contributions to the science of somatology: (1) he has cleared up much of the inaccurate distinctions between basic morphological elements; (2) he has ascertained that *each* element, or component, *exists to some degree* in every individual, on a sliding scale from very low to very high, which he has arbitrarily divided into 7 units, thus avoiding the "type" error; and (3) he has perfected a scopometric technique, combining photography, observation, and anthropometry, which appears to measure degrees of these three components with high accuracy, validity and reliability, based on studies of several thousand "normal" and psychotic individuals.

Sheldon has chosen to consider as the *first* component that element generally identified with and called "digestive" or

"pyknic"; as the *second*, that called the "muscular" or "athletic"; and as the *third*, that called the "leptosomic" or "asthenic"—but with important differences in the recognition of each. It is interesting to note that Sheldon now calls these three components, respectively, *endomorphic*, *mesomorphic*, and *ectomorphic*, terminology strikingly reminiscent of Huter and von Rohden, although Sheldon earlier employed the terms pyknosomic, somatosomic, and leptosomic, respectively. The term *trypherosomic* has also been suggested (Dr. George Gomori, of the University of Chicago Clinics) to denote the first, pyknic, or endomorphic component (Greek: *trypheros* = soft, round, with connotations of femininity, and *soma* = body).

Much of the more recent morphological taxonomy avoids the tendency to bipolarism. The most outstanding work in the anthropology of disease has probably been that of Draper (69, 71). Utilizing anthropometric and anthroposcopic techniques and jaw casts, he describes various disease "races." Draper was careful to state that measurements alone could never express all the subtleties of contour and feature proportions of the human face. For this reason he also recorded impressions.

The groups which he describes in detail are the gastric ulcer, gall bladder, pernicious anemia, nephritis and hypertension, diabetes, acromegaly, acute rheumatic fever, hypertrophy of prostate and pulmonary tuberculosis. Draper is well aware that the individual constitution is a complex organism and does not neglect to tie up morphology with sex, heredity, and psychology. Realizing the importance of serology and physiology, he has recently also begun to study these aspects of constitution in some detail.

2. Applications and criticisms

In an attempt to investigate the functional adequacy of the various types of pelves, Greulich and Thoms (112) computed the percentage of women of each pelvic type who required some sort of operative intervention during delivery. If proof of the adequacy of a given pelvic type is its ability to function efficiently during parturition, say these writers, then the adequacy of the long oval and the round pelves is convincingly demonstrated, for the incidence of cesarean section in a series of 600 cases was:

dolichopellic	0.0%
mesatipellic	0.7%
brachypellic	4.3%
platypellic	15.4%

The "normal" pelvis is found to be far from the transversely flattened type which the literature of obstetrics and even anthropology has claimed, for the long oval and round pelves are much more common to all races and social groups. Strangely, women enjoying a better economic level and a superior physical status had a higher percentage of dolichopellic pelves, a condition which has even been called "anthropoid," but which is actually better adapted for delivery. Greulich and Thoms believe that nutritive and other factors which permit the attainment of maximum normal growth also prevent the undesirable transversely flattened pelvis. It is interesting to note that no association was found between pelvic type and the rest of the body.

Morphology is frequently attacked as a method of approach to constitution by writers who believe it is not important as a deciding factor in the etiology of disease. Feigenbaum and Howat (88) state categorically that "there is little doubt that many attributes of the body which have been said to render a person

displaying them susceptible to a certain disease have actually been produced by disease." They see no connection between physical constitution and three types of disease which they investigated—peptic ulcer, cholecystitis, and diabetes. Using Draper's methods and even arriving at results which agree with his, they nevertheless believe that these results are negative in the light of their own statistical treatment. However, it seems unwarranted for Feigenbaum and Howat to expect to find significant differences on all or any appreciable number of the anthropometric measurements and indices taken. They do make an important contribution in this subject in pointing out the comparative futility of depending solely on anthropometric techniques without integrating and correlating them into a more comprehensive pattern. (For a further discussion and interpretation of their work, see section V. C. 6.)

Hess and Blackberg (127), though expressing faith in the importance of constitution in etiology, conclude that their work in the production of rickets in puppies shows the physical type of the animal is not the deciding factor.

Says Matthew Young (333) after a study of the physical type of a large number of children with asthma and rheumatism, using a third group of normal children as a control:

> The differences in the three groups of children, the asthmatic, the rheumatic, and the normal, in respect to the aggregated physical characters brought under review, are relatively so slight that they cannot be considered to support the view that asthmatic and rheumatic children really differ on the average from one another or from the general population of children from which they are drawn in bodily conformation or physical type, though they may possibly, indeed probably, differ in other constitutional traits.

These critics, far from disbelieving in the constitutional factor, believe that it is necessary to make investigations in other aspects rather than physical constitution. Draper (71, p. 105) himself, who has relied so largely on morphology, has said on the subject: "In itself, the study of human morphology adds perhaps but little; as a means to the larger conception of the man as a whole, however, it is well nigh indispensable."

Aside from investigation of constitutional morphology itself, the rest of research in constitutional studies consists chiefly of the application of morphological techniques and classifications to an investigation of other aspects of the field as a whole. Specifically, it is concerned with studying the correlations between morphology, and physiology, pathology, and psychology, as outlined in the statements of the objectives of constitutional research (see section III). The balance of this paper will be concerned with such interrelationships.

B. Physiological variations related to morphology

As has been stated, the methodology of the investigation of the physiological aspect of constitution has been relatively unsatisfactory,—unsatisfactory in the sense that the work done has not been well integrated and so is less meaningful than it might be.

1. Detailed physiology

But a number of interesting and important investigations have been made relating morphology to physiology. Petersen (230) summarizes many of these in an excellent review, under the following headings:

Blood pressure: the average levels of both systolic and diastolic readings are higher in hypersthenics, and tend to be progressively lower as the body build varies toward the asthenic.

Hematopoietic system: a "greater functional ca-

pacity" is found in the hypersthenics, together with a higher blood count, on the average; the asthenics show a greater tendency to anemia. Petersen quotes Bryant and Liwschin as finding approximately the same correlations, though with slightly different morphological classifications.

Uric acid: increased in hypersthenics even without disease, and is of course especially elevated in patients with obesity, gout, gall-bladder disease, arteriosclerosis, hypertonia, and bronchial asthma, which diseases Petersen states are all comparatively rare in asthenics.

Ferment balance: catalytic energy of the blood is highest in hypersthenics, lowest in asthenics. That is, hypersthenics show in general higher catalytic and lower diastatic energy than asthenics. Petersen quotes Morew as having confirmed these observations in children.

Bilirubin: asthenics show higher values than do hypersthenics.

Capillary permeability: lower in athletics and hypersthenics.

Skin reactions: superficial dilatation of the capillaries occurs commonly in the pyknics, contraction in the asthenics.

Vasomotor stability: more reaction to epinephrine in asthenics.

General tissue reaction: pyknics exhibit an increased irritability of the tissues to various substances early in life, with resulting greater wear and tear in adult life, and the opposite is the case in asthenics. Petersen believes this may be "a trophic principle sufficient to account for the differences in the reactivity of the two types towards diseases" (p. 295).

Fat metabolism: the lipolytic index is greater in hypersthenics, and they produce, use and store fat to a greater extent than do asthenics; there is increased lipemia and lipolytic energy in the hypersthenics.

Carbohydrate metabolism: diastatic enzymes are low in hypersthenics, and higher in the blood of asthenics. The latter, too, show a greater tendency to hyperglycemia: to the glucose tolerance test they exhibit greater lability, in that the blood sugar rises more sharply and returns to normal more rapidly than is the case with hypersthenics.

Respiration: the vital capacity is proportionately greater in asthenics, and they have a better gaseous exchange.

Petersen and Levinson (231) in 1930 studied a series of "normal" men, and divided them, according to a weight-height ratio, into the more slender and the heavier quartiles, discarding the intermediate two quartiles, and contrasted a number of physiological variables in the two groups, with the average age the same in the two cases. They tabulate their findings as follows:

PHYSIOLOGICAL REACTIONS	HEAVY GROUP	SLENDER GROUP
Capillaries	0.57	0.63
Blood sugar determinations (fasting)	73.8 mgm.	69.5 mgm.
K/Ca ratio	2.08	1.81
Threshold of muscular irritability	3.48 m.v.	2.38 m.v.
Epinephrine reaction	+8% incr.	+12% incr.
Cholesterol	225 mgm.	210 mgm.
Reaction to Kromayer irradiation	2 hours	2.2 hours
Carbon dioxide combining power	54.5	58.5

It is obvious that some of these results are probably not significant, especially as no statistical evaluation is presented, but this approach to the problem is nevertheless of interest.

Petersen and Willis (232) also examined the capillary permeability of normal medical students in relation to body build. They found a distinctly lower permeability in individuals of athletic physique than in the group studied as a whole. Brugsch and Lewy (44) found the blood supply in relation to muscular development greater than average, especially in the athletics, and found that if the vascular system was well developed, muscular hypertrophy resulted; if the vascular system was small, no hypertrophy was noted.

Tschernorutsky (306) found a distinct correlation between cholesterolemia and body build, with lower figures in the asthenics, thus in general confirming the figures of Petersen and Levinson given above. Petersen (230) likewise quotes Miasnikow as having obtained the following figures for cholesterol in the blood: 1.8 per cent for hypersthenics, 1.3 per

cent for asthenics, increasing with age in both groups, but maintaining the same differential for each age group.

Gildea, Kahn, and Man (102), in an extremely well done study of certain biochemical-morphological relationships in normal students at Yale, separated the extreme pyknics and the extreme leptosomes, much as Petersen and Levinson did, and found consistently higher figures for serum lipoids in the pyknics than in the asthenics, the average difference being 8.7 times the probable error of the difference for men and 2.5 for the women.

Ortfried Müller (204) noted differences in the skin capillaries of pyknics and asthenics, observing that the pyknics in general had large capillary venous dilatations, as for example, over the nose and cheeks, wide capillaries in the upper chest, venectasia in the pelvic region, and, generally speaking, a capillary bed of the extremities showing less change, than in the asthenics. In the asthenics he noted evidences of a tense neuro-vascular mechanism, as a pseudo-anemic pallor of the face, and bluish, clammy hands with dilated subpapillary venous plexuses.

Katase (144) states his belief that the acid-base balance of the diet has something to do with the body build of an individual. He infers this from animal experiments in which he found that young animals fed on alkaline diets show a relatively broad development as compared with their controls, and animals fed an acid-forming diet exhibit a relatively longitudinal development. Petersen lends some validity to this novel argument when he notes (230, p. 295) that "typically pyknic individuals apparently have a tendency to retain basic valencies as contrasted to the leptosome."

Borchardt (37), in addition to his studies on the relation of heredity to disease (section II. D. 4.), has called attention to the importance of the term introduced by Umber, "histiogenic retention," believing that this deserves broad application in understanding the different physiological qualities of the pyknics and the asthenics. Brugsch (42) employes the same concept when he speaks of the "lipogenic tendency of the tissue" of pyknics. Borchardt goes further in this regard, and states that because of a greater "histiogenic retention" in pyknics, they have better conditions of insulation and lower metabolic requirements, thus explaining his observations that the basal metabolic rate is definitely lower, on the average, in pyknics and higher in the asthenics. J. Bauer (16) likewise speaks of a "lipophilia" in pyknics.

2. Basal metabolism

Lucas and Pryor (181, 182, 183) have also studied basal metabolism with respect to the body build factor, in a very thorough investigation on normal San Francisco children, using chiefly width-length indices as their criteria of body build. On the basis of a very careful and entirely valid statistical analysis of their data they are able to conclude (182) that,

> normal slender-built children normally have higher basal rates than broad-built children of the same age-sex group. High basal metabolic rates as measured by the conventional standards are the rule for the linears whose width/length indices are well below average.

In the slender-built group not only did they find the basal metabolic rate higher, but also the total calories per hour, the calories per kilogram body weight per hour, and the calories per square meter body surface per hour. They conclude that insofar as the width/height index measures constitution, the constitutional factor is to some appreciable extent causative of differences in basal metabolism.

3. Electrocardiograms

As a rather different approach to the study of the "physiological panel" of constitution, Draper, Bruenn and Dupertuis (74) have made a careful study of electrocardiographic patterns. They find a "high degree of constancy over a long period of time in the individual electrocardiographic pattern," and proceed then to examine the possibility of using this in the study of individual constitution. Working with gall-bladder and ulcer patients predominantly, they found the following differences:

Gall-bladder	*Ulcer*
P-R interval longer (especially in 3rd–4th decades)	P-R interval shorter
Q-T interval shorter	Q-T interval extremely long
	Sinus arrhythmias commoner than in normals, especially in 3rd–4th decades
Pulse rate slower than normal	Same, especially in 6th decade
Curve smoother, more rolling	Curve steeper, more abrupt

Their interpretative comment is: "The marked prolongation of the P-R interval, like sinus arrhythmia and a slow pulse rate, expresses a strong vagus influence . . . possibly indicating the peculiar vagotonicity of the ulcer patient." When it is recalled that the ulcer patient is predominantly linear and the gall-bladder patient predominantly lateral in body build (see section V. C. 6.), the above differences may have even further significance. Draper and his associate Coy are at the present time working still further on the problem of electrocardiographic patterns as tools in differentiating physiological variables of constitution.

Little yet is known definitely of the differential physiology of the endocrines with respect to its correlation with body-build. This must await simpler and more adequate techniques of assay than are now available, but promises much for the future. Lacking such data, however, it is yet possible to note certain significant physiological correlations with different morphological patterns. The basal metabolism findings of Lucas and Pryor are particularly important. The suggestion of a higher histiogenic or lipogenic retention in the pyknics must be investigated further. There is much hope in the future of studies along these physiological lines as better correlational techniques will be worked out.

C. Relation of morphology to pathology

1. General considerations

Observations of apparent preponderance of disease with regard to certain rough variations in body build have been numerous. In recent years many of these have been quite well substantiated statistically. For example life insurance records from Trieste, 1926 (Jackson, 141, p. 122), give us the information in Table 4. Jackson states figures in America, Germany, and other countries are in essential agreement with these. Such figures deal only with causes of death, and not all illness, and do not distinguish between bodily habitus resulting from disease or possibly contributing to it. But such correlations, based on mass figures, are not without their value. It is interesting to observe that they seem to confirm the validity of Hippocrates' observations with regard to the "habitus phthisicus" and the "habitus apoplecticus."

Freeman (92) has made a careful study of the relationship between body build and various diseases. He summarizes his findings for 1260 cases, eliminating diagnoses considered less important when more than one was found to exist in a given individual, in Table 5.

From the figures obtained, Freeman finds a relatively high proportion of asthenics among the tuberculous, of pyknics suffering hemorrhagic pancreatitis, of athletics with intestinal disorders. He summarizes (p. 808):

A few other disorders in which the special body type contains more than 40% of the total may be mentioned. Cardiac valvular disease, aortic aneurysm, cerebral thrombosis and hemorrhage, nephritis, pyelonephritis, prostatic hypertrophy and malignancy, pituitary tumors, goiter, and subdural hematoma, occur in considerable numbers in the athletic type. Pulmonary abscess and gangrene as well as pulmonary and intestinal tuberculosis pick out especially the asthenic type, while pyknics comprise a rather high percentage of diabetics. The dysplastics are so few in number that they do not show any strikingly high percentages for any lesions.

TABLE 4

Body build related to mortality

CAUSE OF DEATH	PHYSIQUE		
	Thin (Percent)	Medium (Percent)	Stout (Percent)
Tuberculosis	25.7	13.1	4.1
Apoplexy	4.9	9.2	12.3
Circulatory disturbances	9.4	14.8	22.7
Pneumonia	11.7	10.3	7.7
Malignant tumors	6.4	8.3	7.1
Infectious disorders	5.4	4.6	4.1
Brain disorders	10.6	9.8	6.6
Suicide	4.7	5.1	4.1
Various other diseases	21.1	24.8	30.5
Totals	100.0	100.0	100.0

And, with regard to low incidence diseases, those totalling below 10 per cent of a given disease group, he says (p. 809):

Few aortic aneurysms and cerebral hemorrhages occur in asthenic individuals. Pulmonary abscess and gangrene and bronchiectasis, as well as tuberculosis of the lungs, are rare in pyknics; few cases of nephritis, of prostatic carcinoma, of pachymeningitis and of adrenal hemorrhage occur in pyknics. The dysplastic group is represented by relatively few instances of hernia and of hemorrhagic pancreatitis.

Freeman's final perspective on this problem is given as follows:

. . . certain constellations may be picked out as contrasting examples of human biotypes. The asthenic-tuberculous-schizoid contrasts with the pyknic-angiopathic-cycloid, and both of them with the dysplastic-exudative-epileptoid, while another less striking example is the athletic-paranoid group showing decided tendencies toward malignant disease and chronic streptococcus infections.

Criticisms of all such sets of figures, whether totals from life insurance records, or more careful studies of pathological material, will be unavoidable. Grounds for criticism will include inadequate criteria for morphological classification, inadequate size of sample, and insufficient statistical evaluation. Such objections may well be levelled at much of the work that has been done in studying the relation of morphology to disease. Yet considering only the work more carefully done there are so many reports that it would be not feasible here even to enumerate them adequately.

It is proposed, therefore, that some of the more important diseases be considered as indicative of the better investigations

TABLE 5

Body build related to disease

DISEASES	PER CENT OF CASES IN BODY GROUPS			
	Asthenic	Athletic	Pyknic	Dysplastic
Tuberculosis	66.3	17.4	2.3	14.0
Acute infections	41.1	28.4	14.7	15.8
Carcinomata (all)	29.8	39.6	13.2	17.4
Syphilis (all forms)	28.5	46.6	14.2	17.4
Violent death	20.0	36.7	30.0	13.3
Chronic Strep. infection	16.3	39.5	22.1	22.1
Intestinal catastrophes	15.7	31.6	21.1	31.6
Circulatory disasters	10.0	40.0	41.7	8.3
(Totals all cases, for comparison)	33.4	36.5	15.6	14.5

carried out in this field. The psychoses will be discussed in a following section, as perhaps more properly to be considered, although definite "disease entities," in connection with the relation between morphology and psychology in constitution.

One approach to the study of the relation of morphological variation to pathology is the correlation of somatological habitus with the organs primarily involved in certain disease patterns. An excellent example of this technique is the study of Pearl, Gooch, Miner, and Freeman (223) of endocrine organ weights and bodily habitus. They summarize their findings as follows:

> The average quantitative dosage of endocrine organ tissue per kilogram body weight is greatest in asthenics, less in intermediates ("athletics" of Kretschmer's terminology), and least in pyknics, so far as concerns adrenals, thyroid, parathyroids, hypophysis, epiphysis and gonads, while the relative dosage of thymus tissue is least in asthenics, greater in intermediates, and greatest in pyknics. The difference between the extreme types, asthenics and pyknics, in mean weights of endocrine organs is relative to body weight and generally large in amount, and without exception statistically significant having regard to their probable errors.

Several studies may be listed to indicate the wide variety of pathological fields that have been studied and have led to quite definite clinical conclusions. Benedetti (24) has studied sterility; Ciocco (53) auditory acuity; Lazarowitz (170) luetic aortitis; Freeman (93) has made further studies of the endocrines beside his contribution mentioned above; and Fici (89) has added to the list of workers who have studied the relationship between morphology and disease with apparently definite conclusions.

It is perhaps appropriate that Draper, one of the earliest careful American workers in this field, should be one of the main contributors. In his book *Human Constitution* (69), published in 1924, he dealt with seven clinical entities: gall-bladder disease, ulcer (gastric and duodenal), nephritis and hypertension, pernicious anemia, asthma, tuberculosis, and acromegaly. Draper's techniques have been described elsewhere, and his attempts to recognize "disease races" have been discussed. He presents a mass of statistical data which is exceedingly hard to evaluate. This is essentially an application of anthropometric techniques to the field of medicine, and if it does not show anything else it does prove the difficulty if not the impossibility of using this method as an adequate approach to the problem. Aside from considerations of Draper's mechanisms of morphological evaluation, however, his findings are not without interest, and deserve careful study. In 1925, for example, he published (70) a study on the toxemias of pregnancy, supplementing earlier observations on hypertensives and nephritics, which showed that women suffering from these toxemias have morphological differentiae as compared with other groups which are statistically significant. Many other observations of interest to clinicians and anthropologists are to be found in his writings.

In more recent years Draper has extended his field of medical investigation, but has retained essentially the same idea of trying to differentiate "disease races" by suitable techniques, still chiefly anthropometric, although he has lately become more interested in the "physiologic panel" (see section II. B.). In 1934 he published, with Touraine (303), a study on 50 patients afflicted with classical migraine. He found some minor anatomic differences in these migrainous individuals as compared with a comparable "normal" population, such as: greater upper face (zygomatic) breadth;

shorter upper face height; higher facial index; more receding chin; more marked supraorbital ridges; larger teeth; a well-marked downward, inward slant of the upper eyelid; and narrower hands. In summary, these authors state (p. 2) that "it has not been possible by anthropometry alone to demonstrate beyond question a migrainous type morphologically." They have also studied the psychologic panel of these patients, find them to be arrested psycho-sexually, to have no deep religious ties, to have a "highly colored phantasy life", and conclude that migraine is a syndrome comparable to any neurosis.

2. Heart disease

Pearl and Ciocco in males (221), and Ciocco in females (54) have made very careful studies as to differences of body-build distinguishable from normals, in patients with heart disease. Using the same 13-point scale of morphological classification mentioned in connection with the study of endocrine organs above, they were not able in either males or females to find any significant difference between asthenics, intermediates, or pyknics as to the incidence of heart disease, but did note, particularly in females, that dysplasia is more common than in non-cardiacs. They found cardiac patients to be heavier, it is true, than non-cardiacs, but believed this to be due to "relative over-eating and lack of exercise," without inferring necessarily any etiological relationship in this respect.

Reed and Love (243a), using chiefly a height-weight relationship to determine somatological differences in a very extensive study of the development of disease in the United States Army, found that valvular diseases of the heart resulting from rheumatic fever and other infectious diseases were more frequent in tall thin individuals, at advanced ages as well as in early adult life.

3. Arthritis

Kovacs and Hartung (156) have made a careful study of morphological differences between rheumatoid arthritis and osteoarthritis, essentially to examine the accuracy of the observation made by many, of a relationship between rheumatoid arthritis and the asthenic habitus, and between osteoarthritis and the pyknic habitus. They were careful to equate age and other variables in their statistical evaluation, and obtained the following results: the rheumatoid arthritis group had a tendency to increased longitudinal measurements, with longer and thinner necks; were slender though not necessarily tall, and had weights normal or under average for their age-sex groups; and the osteoarthritis group had a tendency to increased horizontal measurements, with shorter and thicker necks, more massive thoraces and abdomens; and had weights usually above average for corresponding age-sex groups. This seemed in general to confirm the work of earlier observers.

T. F. Goldthwaite (104) was among the earlier observers who pointed out an association of the light-boned, slender, asthenic individual with the rheumatoid form of arthritis. Millard Smith (279), on the other hand, felt that he could not distinguish any particular body type in atrophic arthritis, although he did not use particularly adequate methods for morphological classification, and did find the following percentages with the methods used: asthenic, 48 per cent; intermediate, 28 per cent; sthenic, 24 per cent. Young (333) noted slight morphological differences in children with rheumatism, was not sure that they were really significant, but concluded that such children

with rheumatism may "possibly even probably differ in constitutional traits" from control groups.

4. Tuberculosis

The disease now recognized as tuberculosis, especially in its pulmonary form, has been one of the clinical entities most intensively studied as to the rôle played in its development both by heredity and by constitutional variation. Some of the conclusions with regard to the former have been noted (see section II. D. 4.). And some mass statistics purporting to relate the disease to thin slender or asthenic individuals have been given. But the matter is not simple, and there is much conflicting opinion and evidence.

This is partly due to the nature of the disease, which apparently is an infectious disease, but in some respects does not behave as such. Historically, phthisis was considered as a general disease of the body as a whole that demanded treatment to increase the general bodily resistance. After discovery of the tubercle bacillus by Robert Koch in 1882, however, the idea of the constitutional disposition to tuberculosis was pushed into the background by the great interest in the bacteriological etiology of the disease. It is in the present third cycle of the investigation of the true etiology of tuberculosis that we find much conflicting evidence and opinion, much of the conflict being due to inadequate definition of the issues involved.

Barker (11) in a very thorough consideration of the whole subject seems to be entirely uncertain as to the possibility of a real constitutional factor in the disposition to tuberculosis. He finds a correlation between constitution and the development of the disease, it is true, but feels that because constitution has a high correlation with hereditary determinants (an interesting observation in itself), this positive correlation is not so much due to constitution *per se* as it is to the hereditary factor. This seems to be begging the question, for he recognizes that the best use of the word constitution is to signify the human phenotype, including both genotypic and paratypic elements.

H. J. Halford (121) believed constitution, as determined by body weight proportions, not to be a significant factor in resistance to the infection, on the basis of averages for various stages of the disease (none, occult, quiescent, and manifest). But it is interesting to note that he found among children with pulmonary tuberculosis a high incidence of narrow chests. Hetherington (128), along the same line of investigation, did not find children with tuberculous infection, as measured by the tuberculin test, to be more frequently underweight than children with negative tests.

Satke (255) is typical of many who also are not sure of the rôle of constitutional disposition to tuberculosis. He points out that the phthisical habitus has been interpreted as being particularly susceptible to tuberculosis, but that many believe it to be the consequence of the disease. He also has difficulty distinguishing between "congenital resistance" and "constitutional resistance," but does finally admit that the asthenic habitus "is probably more susceptible to tuberculosis."

On the other hand there have been many workers who have found valid positive correlations between body build and predisposition to tuberculous infection. Typical of those writers who have found the slender, asthenic individual peculiarly liable to develop pulmonary tuberculosis are Beneke (29), Neuer and Feldweg (211), Saltykow (253), Stefko (288), Warstadt

and Collier (322), and Klare (150). Stiller (292, 293), among the older authors, associated with this type a definite lack of resistance to tuberculosis. Draper (69) notes one morphological point that is found quite often in tuberculous patients: a small (24°–55°) subcostal angle. Ickert (140) notes that 80 per cent of tuberculosis patients are asthenic as compared with only 14–15 per cent of the general population. Luxemberger (184) concludes that there is a close correlation between the leptosomic habitus and tuberculosis. Wheeler (331), describing the two major human body types with great clarity, states that the linear or asthenic has a definite tendency to tuberculosis. Neumann (212) observes that the "asthenic-schizoid types are particularly susceptible" to tuberculosis. And Scammon and Petter (258) showed in a careful study that tuberculous children were below average weight for height, and weight for height for age.

Pryor and Mathiason (238) have done perhaps the most careful anthropometric study of tuberculous individuals. Comparing 210 tuberculous children with 6000 healthy children in the San Francisco area, equating age and sex, geographical and racial origin, and many other factors, they found that (a) the tuberculous children consistently varied from the average toward a slender build; (b) width-length indices were smaller for both sexes at all age levels in the tuberculous; (c) head and face measurements were smaller; (d) necks were longer and of smaller circumference; (e) chests were more barrel-shaped; and (f) nutrition was just as good in the tuberculous children, compared with the normal population, taking into account the more slender body build.

Bearing on points made by Halford and Pryor and Mathiason above, is the interesting little book by Professor Weisman (324) of the University of Minnesota, with a foreword by Dr. Richard E. Scammon, entitled *Your Chest Should Be Flat*. Weisman with very adequately prepared statistics considers only the thoracic index but finds it definitely higher (thorax deeper in proportion to its breadth, or, narrower in proportion to its depth) in tuberculous children than in non-tuberculous controls. While interesting, his conclusions would seem to have more significance if they had been based upon a more comprehensive evaluation of the morphology involved in the disease than merely the thoracic index.

Reed and Love (243a) found that the majority of U. S. Army officers who developed tuberculosis were tall, spare individuals; and that they were clearly differentiated as to a height-weight relationship 10 and 20 years prior to the development of the disease.

Petersen (230), summing up all the evidence available on the subject of constitution and tuberculosis, and considering both the hereditary and morphological aspects, states categorically his opinion to be as follows (pp. 304–305): "Freedom from clinical tuberculosis depends on natural resistance and not immunity. There appears to be no escape from the conclusion. . . . Constitution, genotypic and paratypic, may therefore be the determining factor in an infectious disease such as tuberculosis." On the basis of the available evidence, Petersen's conclusions would seem to be warranted.

5. Gastro-intestinal disease

Next to lungs with tuberculosis, the abdomen seems to have been the favorite hunting ground of constitutional morphologists, with gall-bladder disease and ulcer the commonest diseases studied. Here should be mentioned again the work

of Draper (69), whose chief findings were that ulcer patients had longer, thinner necks than did cholecystitis patients, and a number of other minor similar morphological differences.

Ptosis of the stomach and other abdominal organs has attracted a number of workers. Kaufmann (145), for example, examines 83 cases of "chronic digestive insufficiency," meaning chiefly chronic undernutrition, and found that 62 per cent (51) of these had "asthenic characters," employing Stiller's criteria. He finds a relationship between digestive insufficiency and ptosis and asthenic habitus; and then adds, gratuitously, "ptotics have a longer life than the average"!

Fauszt and Augustin (86), employing observational, anthropometic, and statistical techniques, also investigated the relationship between ptosis and body build, and found that asthenics had a definite tendency towards ptosis. It is unfortunate in both these studies that the criterion for ptosis is not more clearly stated, although Kaufmann does state he means ptosis when the lesser curvature of the stomach is not above the level of the iliac crests. Todd (302), however, has shown that the position and shape of the stomach are highly variable, and is in part a function of the time of day, relation to mealtime, size of meal, nature of content, etc., and certainly these factors were not controlled adequately.

6. Gastric and duodenal ulcer

In the field of gastro-intestinal diseases the single entity that has been studied most often with regard to constitutional correlation has been peptic ulcer, both of the stomach and duodenum. This probably has been primarily because of the very common clinical observation of the frequency of the disease in individuals of linear build.

A cursory review of the literature on this particular subject reveals the trend of observations with regard to ulcer and the "asthenic habitus," chiefly as defined by Stiller. Stiller (292) himself in 1907 was one of the first to note the great frequency of ulcer in asthenics, and of the asthenic habitus in ulcer. Others who in general agreed with this observation through the earlier part of this century have been, in chronological order: Möller (202), 1911; Adolph Schmidt (260), 1913; Westphal (328), 1917; Kroug (163), von Krempelhuber (314), and Grote (114), 1919; and Kuttner (166), E. Schütz (263), and Strümpell (297) in 1920. It is well to keep in mind that constitutional morphological classification was still somewhat tentative and chaotic in this pre-Kretschmerian period.

Perhaps as a result of lack of clarity of definition of the various habitus pictures, there quickly appeared reports of several men who did not agree with the above, that the asthenic was necessarily correlated with predisposition to ulcer. Cohnheim (58) in 1921, e.g., in 1000 ulcer cases often found the body build to be quite heavy and robust, though he does not compare with controls. Hegemann (124) also in 1921 found among 100 ulcer patients only 15 individuals corresponding to Stiller's description of the asthenic, not a significant frequency. And von Bergmann (312) in the same year presented the interesting argument that there has been an observed antagonism between ulcer and tuberculosis in the same individual, that it was maintained that the asthenic was more susceptible to tuberculosis, and so how could both tuberculosis and ulcer be correlated with the asthenic habitus? Von Bergmann probably would have been more correct if he had suspected the relationship of the asthenic with

tuberculosis than with ulcer, in the light of later work.

At this stage of the modern evolution of clinical morphological taxonomy, Kretschmer contributed a large step forward in clarifying the picture. In the first editions of his book, *Physique and Character* (158), in 1921 and 1922, Kretschmer was very vague as to an accurate description of the asthenic physique; and the photographs published did not lessen the confusion. But in later editions Kretschmer took great care to distinguish between two elements in the "asthenic habitus": (a) linearity, and (b) slenderness, fragility, gracility; and emphasized the latter quality, manifesting itself in various parts of the body, as the important variation in physique toward the upper end of the height-weight distribution. This kind of physique he then called "leptosome," no longer "asthenic." In other words, he recognized that linearity was part of both the leptosome and the athletic, but fragility, slenderness, *per se*, was a separate physical character. This also helped him better to recognize his "athletic" type, but still there was an inadequate delineation between athletic and pyknic.

Following this slight reformulation, further workers took up the study of ulcer and body build, now chiefly interested in the rôle of the "leptosome habitus." In 1923 Tscherning (305) found a significant preponderance of individuals with this habitus among ulcer patients, and in 1926 Ruhmann (252) in a well-prepared study confirmed Tscherning's observations.

Among still more recent workers, Fauszt and Augustin (86), already mentioned in connection with ptosis, noted that the leptosomic habitus is the "terrain for both ptosis of the stomach and gastric ulcer," but differentiated between the leptosome and the musculo-athletic habitus, finding the latter a terrain for ulcers of the pylorus and duodenum. These authors used anthropometry carefully and employed rigid statistical techniques, and found significant differences in body build between patients with gastroptosis and gastric ulcer on the one hand, and pyloric and duodenal ulcers on the others, and no significant differences between gastroptotic and gastric ulcer individuals, or between patients with pyloric and duodenal ulcers.

Goralewski and Schreiber (105), on the other hand, in a paper not at all well presented and giving no adequate statistics, do not believe it is possible to classify ulcer patients in a uniform constitutional picture on the basis of our present knowledge, if one tries rigidly to arrange them in any of the usual schemata, purely somatic or otherwise.

Caroli and Corman (49), in an extremely well prepared paper, do find significant differences between body build and ulcer, as well as the location of ulcer. They used only cases confirmed by clinical and roentgenological examination or by both and surgical intervention. Their morphological classification, based on observational techniques supplemented by several carefully selected measurements, divided the patients somewhat according to Stiller's scheme, into *longilignes* or linears, and *brévilignes* or laterals. Many interesting morphological points are noted by these authors, including the especially interesting one that the typical ulcer patient is one who is as much "athletic" as "asthenic," thus agreeing with observations made by Tscherning (305), Ruhmann (252), and Draper (69). In addition, they found it possible to establish the following rules: "The more the linear morphological type tends toward

the lateral, the greater is the frequency of localization of the ulcer in the duodenum; and the less pronounced the tendency to cicatrization." (49, p. 44.)

Draper's delineation of an "ulcer race" has already been mentioned. In two articles that well merit careful consideration, Feigenbaum and Howat (87, 88) of McGill, have reëxamined Draper's thesis. They have used a sample of different racial stock in general, but otherwise have examined an approximately parallel cross-section of the disease population. They have practically repeated Draper's measurements on such patients. And it is their own conclusion (88, p. 454) that "on the whole the two sets of figures are comparable." They agree with Draper that ulcer patients have significantly longer necks than do gallbladder patients, that they have thinner, smaller chests, and proportionately longer limbs, and a few other similar observations. They employ a rigid statistical criterion for the determination of the significance of such differences.

But they found comparatively few differences between disease groups, of all the 37 measurements taken and eight indices calculated. In fact, they found that among the possible comparisons for both sexes only 19 per cent of the measures were significant in detecting differences, and only 6.6 per cent when both sexes were considered for the same measurement. They believe that if Draper had submitted his own data to a similar analysis similar results would have been obtained. From this analysis they are able to make the deduction (88, p. 449), "it can be stated categorically that the physical constitution of a patient is not a deciding factor in the etiology of peptic ulcer, cholecystitis, and diabetes." If they had made the additional reservation, "on the basis of this analysis," such a conclusion might be tenable. But it seems illogical, as has been pointed out elsewhere, to conclude that there must be a significant difference between all, or even a high proportion, of anthropometric measures, of all parts of the body, of two disease groups, before it is permissible to recognize significant differences in physical constitution. The chief contribution of Draper and Feigenbaum and Howat in this field would seem to be the futility of depending exclusively on anthropometric techniques in determining body build differences. It would seem more logical to use the careful scientific methods of Caroli and Corman, employing both observational and mensurational techniques. The argument for the scopometric analysis of the human body has been presented in a previous section (see IV. A.2.c.), as that which, on the basis of the best work done in this field, seems the best suited to give the most meaningful yet valid results.

In general, then, the work investigating the body build of ulcer patients seems nearly uniform in the conclusion that there is some relationship between body build and this particular disease diathesis.

7. Conclusions

Caroli and Corman (49), in concluding their paper, are so impressed with the possibilities of this constitutional approach to clinical medicine that they state, "It is possible to establish the greater or lesser frequency of each morphological type in the principal digestive diseases, and this recognition enables one to have at one glance a first impression which the clinical examination will often confirm." This seems, in essence, clearly and adequately to express the usefulness of the constitutional approach to the entire field of medicine.

D. Psychology

Research in constitutional psychology has been both scientific and pseudo-scientific.

1. Pseudo-scientific

Among the pseudo-scientific attempts to demonstrate that the body may reflect the personality are physiognomy and phrenology. It was the contention of Lavater (168) that by the analogy that each species of beast has a peculiar character as well as a peculiar form, one can infer that in man, too, predominant qualities of the mind are expressed by predominant forms of the body. Lavater made other analogies: "Large oranges have thick skins, and little juice. Heads of much bone and flesh have little brain. Large bones, with abundance of flesh and fat, are impediments to mind."

In the fourth volume of his *Essays on Physiognomy: For the Promotion of the Knowledge and the Love of Mankind* he presents one hundred rules to express the relations between various physical features and qualities of mind. According to Rule LXXVII, "A broad brown wart on the chin is never found in truly wise, calmly noble persons."

The foremost physiognomist of the present, Katherine Blackford (32), illustrates how far the "science" has departed from Lavater, for nowadays voice, color, texture of skin, bodily build, posture, gait, handshake, gestures, and clothing are also utilized. Applying her "law of color" to a study of blonds and brunettes, she describes the characteristics of each. Paterson and Ludgate (217), in examining the validity of her statements, discovered that the actual correlation is about zero. Physiognomy has been almost completely discredited by others, such as Kenaghy's (148) work on blond and brunette salesmen, Cleeton and Knight's (56) survey of various character traits, Sommerville's (281) disproof of a relation between big noses and intelligence, and the celebrated work of Goring (106) on atavistic traits in criminals.

The pseudo-science of phrenology was fathered by Gall (96) and Spurzheim (283) over one hundred and fifty years ago. Believing that certain mental traits are localized in the brain, phrenologists reasoned that the great use of any particular trait would cause hypertrophy in that area, so that the bumps of the head revealed the mental characteristics dominating the person's total make-up. Modern findings cast doubt on our knowledge of brain localization, except for motor and sensory control, and neurology disproves the correspondence between contour of the brain and specific unevennesses of the skull. Pearson (226) in 1906 showed, moreover, that it is not true, as the phrenologists claim, that intellect and size of brain and skull go nicely hand in hand.

The physiognomic and phrenological systems of character analysis have a serious flaw. They assume that physical and mental traits exist as discontinuous and clear-cut units, whereas they probably are merely points in a curve of general distribution.

Although the postulates and methods of the pseudo-sciences physiognomy and phrenology have been in large part discredited, it is important not to reject completely the possibility of correlations existing between physique and personality, but to proceed with caution in this difficult but significant field.

2. Scientific

a. Intelligence and body-build

Numerous investigations have been carried on with the intention of proving or disproving a relationship between

body-build and intelligence. Some work seems to give positive indication that persons of greater stature and weight are of greater mental development. Among these may be cited Gowin's (108) indication that major executives in various fields are taller and heavier than minor ones in the same fields.

Due to the possibility that stature may add to a man's prestige because people, believing tall men *are* more capable, will rate them so, investigators in this field have turned their attention to children. Many results show taller children to be more intelligent, but most have employed faulty techniques and methods of analysis. The survey in Honolulu by Murdock and Sullivan (207), almost beyond reproach in method, reveals a correlation between height and intelligence that is so slight that it cannot be considered important. In fact, it may be concluded that though there is a slight positive correlation between intelligence and physical development (weight and stature), the relationship is not very important.

A somatotypic basis for intelligence has been both claimed and disproved. That it is the quality and not the quantity which varies with body build is the belief of Boldrini and Mengarelli (36), who, working with a group of 1000 Italian intellectuals (university professors), found leptosomes were inclined towards an abstract thought and pyknics toward technical and concrete thought. Naccarati (208) believed he had established the fact that microsplanchnics are more intelligent than macrosplanchnics. His index of body-build was height/weight, though he had expressed a preference for a different index, length of extremities/trunk volume, but this could not be utilized because not all the measurements were available. His groups were made up of insufficient numbers, men and women were often intermingled, and there was a large percentage of Jewish students, a factor which might have greatly influenced the results.

The researches of Heidbreder (125), who avoided Naccarati's errors, gave essentially negative results, as did those of Stalnaker (285), Sheldon (272, 273), Garrett and Kellogg (98), and Sommerville (281). Naccarati had approached his problem with an *a priori* belief that the endocrines were related to intelligence and body type.

A good summary of this general field is made by Paterson (215, 216) and Klineberg (151).

b. Body build and temperament and psychoses

Perhaps the major part of all the work done in trying to correlate body build and temperament has been an attempt to ascertain whether Kretschmer's theories are to be accepted as valid or not. For this reason we shall first of all describe his claims and their background.

The great psychiatrist Emil Kraepelin was the first to delineate the manic-depressive and schizophrenic ("dementia praecox") types of insanity. Following this, Bleuler (34) contributed a greater understanding of the symptoms and individual contents in schizophrenic processes. Reflecting on this classification, it occurred to Kretschmer that the boundaries between sickness and health were often quite blurred and that the two great form-groups which Kraepelin had "dragged out of the bewildering chaos of clinical phenomena" passed over in a gradual manner to healthy classifications of two corresponding kinds—"cyclothymic" and "schizothymic." He believed that ordinary people seemed to belong to one category or the other, but in addition it appeared to him that correlated with the two great types of disease and human

nature were certain morphological characteristics. In 1921, he first published his famous *Körperbau und Charakter* (158). Therein he described both the psychic and physical types, and how they were related to one another.

On the basis of clinical observations and a few measurements, he classified body types into asthenic (later called leptosomic), athletic, pyknic, and dysplastic groupings—very similar to the "combinations" of di Giovanni (68). These types were highly subjective, and Kretschmer believed that it was best that they be so. In general, Kretschmer found that the leptosomatic, athletic and dysplastic types were the schizophrenes and the pyknics the circulars.

Then Kretschmer went beyond the psychoses and included normal personalities. He recognized a gradual gradation from the psychoses to "normality"—circular insanity, to cycloid temperament, to cyclothymic personality; schizophrene psychosis to schizoid to schizothyme.

Possible criticism of Kretschmer's work is overwhelming: small series; limits of the sampling (race); scantiness of measurements and absence of indices; use of subjective estimates; failure to classify data according to age, sex, intelligence, and social status, etc.

Yet, investigations to verify or disprove his ideas are numerous—a reflection of the far-reaching effect he has had on constitutional thought. It is difficult to say what the consensus of these investigations has been.

Wertheimer and Hesketh (327), in an endeavor to reduce the method of classification to a point where it could be handled statistically, devised an index whose values they hoped would express definite relation to the body types obtained from observation. Points on the frequency curve are used to classify the asthenic, athletic, and pyknic types. They were unable to differentiate morphological types by the use of anthropometric measurements.

Von Rohden (317) tends in part to substantiate the Kretschmerian typology. Analysis of his data shows that the manic-depressive type is frequently pyknic, and seldom athletic or dysplastic; the epileptic is frequently athletic and dysplastic, seldom pyknic or leptosomic; the schizophrene is frequently leptosomic and dysplastic, seldom pyknic and athletic.

In making his study von Rohden utilized weight and body measurements and defined his type through the use of nine separate indices of body-build (Pignet, Rohrer, etc.). It may be due to this difference in method of arriving at a typology that von Rohden's percentage of leptosomes is far greater than Kretschmer's. An additional factor operating in the same direction is that von Rohden procured his subjects not from among the Schwabians but the middle-Germans.

Although this study shows the manic-depressives to be overwhelmingly pyknic, it is amazing that the schizophrenes vary very little in percentage from the "normal" population. In other words, the characterization of the schizophrene has little significance except as contrasted with the manic-depressive, who is really differentiated from the general population.

Cabot (47) quotes a number of workers having used essentially Kretschmer's typology in a study of psychoses, including among others Burchard (46), Campbell (48), Farr (85), Garvey (99), Gurewitsch (115), Lederer (171), Ossipowa (214), Shaw (270), Ssucharewa (284), and van der Horst (307). He summarizes with the statement (47, p. 23) that ". . . where subjects have been psychotic patients it has been shown that in general there is

a positive correlation between types of physical habitus and the schizophrenic and manic-depressive syndromes." Stevenson and associates (291) have sought to test the validity of Kretschmer's observations on a group of 100 male Chinese psychotics from Peiping hospitals, and quote a number of interesting similar studies on other Oriental stocks. The marked preponderance of leptosomatics which they found is hard to explain, unless it is because the authors have limited themselves to skeletal measurements only, though they have attempted to assay the influence of weight. This distribution is seen to be the more unusual as contrasted with the temperamental breakdown of the group: predominantly cyclothymic, 61; predominantly schizothymic, 30; with 9 individuals approximately equal. Racial considerations are well taken into account in the psychological evaluation. The authors conclude (p. 468): ". . . a psycho-physical correlation of the kind or degree required to conform to the Kretschmer hypothesis must be declared not proven." In view of the many factors to be taken into consideration in comparing their results with Kretschmer's, it is difficult accurately to evaluate their conclusions.

An important lead is suggested by the work of Connolly (59) on 100 male psychotic patients. He found that if paranoid dementia praecox subjects were separated out from the other dementia praecox groups they fall into a different type, namely, the pyknic, and in this respect are more allied to the manic-depressives, though they are even more robust than these in build. This serves as a reminder that negative results in constitutional research may often be laid to the door of our inadequate knowledge of the categories with which we are endeavoring to make correlations.

Connolly's results were somewhat anticipated in this respect by those of Freeman (92) published in 1934. He found that paranoids are to be grouped with persons of cycloid rather than schizoid personality.

European investigators claim a significant correlation between habitus types as classed by Kretschmer and many mental and sensori-motor performances. A summary of the work of Munz (206) and Enke (79) with the Rorschach test; of Scholl (261), Kibler (149) and Enke (79) with the tachistoscope; of Enke (82) with psycho-galvanic reflexes; of Pfahler (233) in the determination of perseverance; of the Russians with differential psychomotor responses and physiological functions; of Wertham (326) and Enke (80, 81) in perception span, reaction times, abstraction, *Spaltungsfähigkeit* or "cleavage capacity," sensitivity to color and form, word associations, affectivity tested by means of the psychogalvanic reflex, tapping rate, handwriting and intelligence; and of Kretschmer and Enke (160) in psychomotor and affective characteristics of athletics, seems to characterize the types as follows:

". . . pyknics are more susceptible to color than either leptosomes or athletics; their associations are more colored by feeling than are those of subjects belonging to either of the other two groups; they excel in the description of details. Compared with leptosomes, pyknics are more synthetic, objective and adaptable in their mental disposition while their motor coordination is also superior. In handwriting, pyknics are freer, more labile and expansive than leptosomes. Compared with pyknics, leptosomes are more sensitive to form; their ability to dissociate is more marked and they are more "perseverative" in their associations; their descriptions are subjectively determined; they are emotionally restricted, analytical, abstract, inelastic, and they find it difficult to relax." (Cabot, 47, p. 23.)

American research does not, in general, substantiate these findings, although Sheldon (271) did find low correlations be-

tween body build and certain social traits. Klineberg, Asch and Block (152) divided a group of 153 male college students and 175 female college students into pyknics and leptosomes and tested for cancellation of numbers, incidental memory, *Spaltungsfähigkeit*, digit memory span, mental ability, scholastic aptitude and withdrawal aptitude. Correlations were found to be insignificant. These authors, who employed three different methods of classifying their subjects into the leptosome and pyknic groups, believe their study does not substantiate the presence of two psychological types in the normal population, though they make the reservation that Kretschmer's typology may nevertheless hold in cases of marked maladjustment. Klineberg and his associates suggest that the German workers dealt with persons of heterogeneous age, intelligence, social, economic and educational background; that their tests were of unknown reliability; and that they failed to employ measures of dispersion or to establish the significance of differences between measures. The German investigations have been surveyed in detail in a series of papers edited by Kroh (162).

On the other hand, Klineberg, Asch and Block may be regarded as unjustified in suspecting Kretschmer's types of being "another ballet of ghostly categories" for the reason that their criteria of psychological types—perceptual recognition, memory span, and general information—are not necessarily valid means of indicating differential responses. Kretschmer (158) attacks studies of this kind because

> "The mathematical-experimental method suffers from a greater dearth of facts, and from the purely empirical standpoint, it invariably amounts to a clumsy abstraction which at best isolates a small number of factors from a complex of factors and treats them as representative of an infinitely more complex object." (Pp. 177–178.)

The total personality pattern, not isolated psychological traits, states Kretschmer, ought to be the basis of evidence.

The Russians have consistently substantiated Kretschmerian typology in children. Krasusky (157) found a clear connection, in Odessa children, between cyclothymic temperament and pyknic constitution, and between schizothymic temperament and leptosomic build. Constitutional and temperamental types are as evident among girls as boys in his series. The extensive researches by Ossipowa (214), Gurewitsch (115), Ssucharewa (284), Oseretsky, Lederer (171), Motschan, Coerper, Nikolajew and Jislin, centering around the Psychoneurological Clinic for Children at Moscow, have been devoted to applying Kretschmer's classifications to children.

In reviewing the researches made on Kretschmerian typology, then, it may be stated that whereas there has been general agreement that the manic-depressive and the schizophrenic psychoses bear some definite relationship to the pyknic and the leptosomic habitus, respectively, there is less certainty in dealing with the more normal cyclothymic and schizothymic personality patterns of such a relationship. Some claim that both morphological and psychological categories may be distinguished in early life—indeed, in infancy.

Brandt (40) also interprets the biological significance of the psychoses dealt with by Kretschmer. He says that the manic-depressive psychosis is a differentiative phenomenon of retarded physical development, passing into "mature old age," having expressed itself, biologically speaking, in the form of a simple, uncomplicated (one might say, metaphorically, "childlike") behavior. The schizoid psychosis, says Brandt, seems a biological phenomenon of accelerated

growth, and schizoids can even in childhood and puberty suddenly express themselves, biologically speaking, in the form of an infinitely complex, or "adult," pattern of behavior.

c. Crime and morphology

In his *Crime and the Man* Hooton (134) claims that there is an association between body build and type of crime. He recognizes that all body build types are likely to be associated with some particular kind of crime: "a short, fat man might under sufficient provocation murder his wife in complete defiance of his body build proclivities." The most striking of his findings, which take into consideration the influence of race and social condition, is the relationship between shortness and slenderness to burglary, larceny, and previous conviction; between tallness and murder; and between shortness and fatness and predilection for sex crimes. Among Negroes and Negroids, the various categories of offenders are physically almost as distinctive one from the other as is the case among whites.

Hooton is convinced that there is some sort of a relation between body build and temperament and behavior. His proof that rape and other sex offenses decrease with stature and increase with weight may, we believe, indicate support of the popular contention that short-legged men make the best lovers. The fact that tall slender men "seem completely uninterested in this type of activity" suggests the possibility of hypogonadism.

One naturally wonders what Hooton discovered in connection with Lombroso's belief that criminal behavior is a primitive or atavistic phenomenon and that criminals may have physical anomalies, not possessed by the law-abiding, which are of *atavistic* or *degenerative* origin. Lombroso and his followers intermingled these two theories, which are really quite different, in that atavism is a reversion to a primitive or subhuman type of man, and degeneracy is due to the cessation of progressive evolution and the beginning of devolution. Both of these theories emphasize the hereditary basis of antisocial conduct and the biologically anomalous character of the criminal.

Hooton's vast survey shows that criminals "do not bear the brand of Cain, nor any specific physical stigmata whereby they can be identified at a glance." This contradicts Lombroso's claim that there are but two types of men, normal and criminal, and that the skulls of criminals bear larger percentages of primitive and pathological features. But Hooton did find that among whites, particularly among Old Americans, criminals are biologically inferior to civilians. This was not true among Negro and Negroid criminals; in fact, the criminals in some ways appeared to have stronger and more vigorous physiques than non-criminals.

Approaching the Lombrosian theory in another way, Hooton studied Negroes and Negroids. For if criminal behavior is a primitive or atavistic phenomenon, Negroes should show "a purer distillation of criminality associated with primitive characters than among the more sophisticated and possibly more degenerate whites." It was considered valid to make this inquiry because it is only a few generations since the Negroes in this country were possessed of a primitive African culture. The analysis indicates no substantiation for Lombroso. Negro and Negroid are prone to murder, but commit less rape and other sex offenses, less burglary and larceny, than many of the nine white racial types. If these

people are lower in forms of criminal activity other than homicide, it might be argued that certain social and economic forces are at work. The problem is truly a complicated one.

Lombroso's theory had been severely attacked in 1913 by Charles Goring (106), a medical officer in the English prison service. Goring appears, like Hooton, to have discredited the Italian criminologist, but actually did not wholly do so, as has been commonly supposed. Hooton speaks extremely harshly of Goring's use of "his statistical genius to distort the results of his investigation to conformity with his bias," a bias which Goring himself professed at the outset of his book, *The English Convict* (106, pp. 24–25). According to Hooton, he was "an evangelical humanitarian" who perverted evidence, made objectionable and illegitimate use of statistical processes and sophistries, etc.

As a matter of fact, while disbelieving in Lombroso's doctrines, Goring nevertheless came to the conclusion that the criminal diathesis is an actual fact, and that it consists of a biological inferiority. "There is no such thing as an anthropological criminal type," said Goring,

> "but despite this negation and upon the evidence of our statistics, it appears to be an equally indisputable fact that there is a physical, mental, and moral type of normal person who tends to be convicted of crime: that is to say, our evidence conclusively shows that on the average, the criminal of English prisons is markedly differentiated by defective physique—as measured by stature and body weight; by defective mental capacity—as measured by general intelligence; and an increased possession of wilful anti-social proclivities—as measured, apart from intelligence, by length of sentence to imprisonment." (Pp. 269–270, abr. ed.)

Goring stressed the constitutional factor in criminals and placed it above the environmental. It is to be noted that Goring, like Hooton, differentiates the body build of criminals according to their offense. For example, "tall persons are relatively immune from conviction of rape," and "crimes of violence are associated with the finer physique, health, and muscular development." In view of this, it is surprising to see the statement that "he did not solve the problem of the relation of the offense to criminal physique."

In connection with the belief that the criminal is biologically inferior, it is to be noted that von Rohden's work indicates it is the athletic who shows the highest frequency of criminality relative to his proportion of the general population. This is at variance with Hooton's belief that the biological inferiority of the criminal is expressed by his linearity or smallness of transverse dimensions. Von Rohden (317, pp. 495–496) cites the findings of Michel and Böhmer, who both found that the athletics constituted 56 per cent of the criminals whom they investigated. Since Hooton is not completely clear as to why he regards certain body-types as inferior, his conclusions must be accepted with caution, especially since he bases much of his eugenical program on this assumption.

E. Survey of research

It is now possible to conclude that, imperfect as is modern constitutional methodology, many definite results have been obtained. These chiefly show presence or absence of relationship between morphological elements of the constitution and other biological variables that are susceptible of objective evaluation. In the field of physiology, definite results are not numerous; in pathology, a not inconsiderable body of evidence would suggest that for many diseases consti-

tutional factors are largely determinant as to their development and course; and in the field of psychology more tenuous conclusions may be drawn as to the relationships between morphological variations and preponderance of certain psychological traits.

Attempting to see the entire problem of constitution in perspective, it seems clear that one reason why more positive information has not been obtained is the obvious fractionation of the entire field of biology. Thus the program suggested by many and proposed by Professor Hooton of Harvard (133), of a study of constitutional problems by scientists from at least the fields of anthropology, biology and psychology, working together as a unit, seems to merit serious if cautious consideration:

> The purposes of such an institute for research in applied human biology might be enumerated as follows: to establish ranges, norms and variabilities in the fields of human morphology, physiology, psychology and neurology; to investigate age changes in man from his conception to his dissolution; to determine racial susceptibilities and immunities; . . . to investigate human heredity and to apply the results of such research to medical practice; to lay the foundations of a rational science of eugenics.

The job is huge, the prospect discouraging, but the benefits to man himself from such a program are potentially enormous.

VI. SUMMARY AND CONCLUSIONS

(1) Examining the history of man's reflections upon the nature of his own constitution, it is evident that the subject has been given serious thought in every period of recorded history. Early emphasis was first upon "humoral," then on "temperamental" differentiation; in more recent times, as more has become known of man's inner structure, certain assumptions have been made correlating organs and systems with behavior, and these have become, in more refined form, the beginnings of modern endocrinology; the contemporary period has been characterized, until quite recently, by a relative neglect of the study of constitutional factors in man for the more spectacular research into the nature of environmental forces as they affect man, following the great scientific advances of the last two generations. But through every period of change in attitude, man has been seriously speculating about his body and its behavior, and wondering about their interrelations.

(2) It is generally agreed that the nature of man's constitution is his entire biological make-up, largely determined by the genetic factors of his heredity, but influenced to an indeterminate extent by environmental forces. Other closely related factors are race and sex. For the sake of convenience, constitution may be divided into morphological, physiological and psychological aspects, with pathology possible in each, to be considered an "abnormal" variation of certain biological properties from an individual or group mean. Heredity is observed to be the major determinant of the morphological aspect of constitution, with environment, including the passage of time, playing a minor rôle; in the physiological aspect, and still more in the psychological, biological behavior is less related to heredity, more influenced by environment; both heredity and environment exert an appreciable influence on the development of disease, depending chiefly on the kind of pathology involved, but disease is never entirely independent of inherited factors. Morphological, physiological, and psychological aspects of man's constitution, as determined by both heredity and environment (and their correlated factors, race and sex), all

essentially are integral parts of man as a "complete psychosomatic being," and it is necessary constantly to keep in perspective this unity in dealing with the complexities of constitutional problems.

(3) The usefulness of a study of man's constitution, from both theoretical and practical standpoints, is seen to be more accurate prediction, in a true statistical sense, of biological behavior. Constitutional investigation is to be regarded as an additional arrow in man's quiver of available methodology for the solution of many biological unknowns, that he may the better control his own destinies, both as an individual and as a species.

(4) The means by which man's constitution may be investigated have been elaborated by modern scientists—physical anthropologists, biologists, psychologists, clinicians—and are well known. Modern biometric analysis of data so obtained is of material assistance in avoiding errors of interpretation. Constitutional study today consists chiefly of investigating relationships between the more fixed morphological elements of man and the less fixed, the physiological, pathological, psychological. Fruitful study of such correlations depends on adequate systems of classification, and such are generally lacking in nearly all fields of constitutional investigation, especially the last named, the less fixed aspects.

(5) In morphology, however, distilled from the observations of many men over a period of many years, a valid and meaningful taxonomy seems to be condensing, in which may be recognized basic elements, or components, of body build, which give promise of meeting the demands of a system of classification heretofore unsatisfied. Seemingly the most significant system of morphological classification developed recognizes three basic components existing simultaneously in every individual, each varying in a "normal" continuous distribution—but in a different dimension—when man is studied in the mass.

Such a system, employed in one modified form or another by most investigators, has led to many positive and many negative conclusions, when morphology has been correlated with other aspects of constitution. Negative results have in many cases been due to technical imperfections of investigation, or to limited scope and perspective in making the study; and in many cases, in well conceived, carefully executed researches, have demonstrated true absence of correlation between the variables selected for investigation. Positive results, too, have been attended by faulty technique and limited scope; but even in these studies, and especially in the more adequate investigations, which are increasing in number, there is accumulating sufficient evidence to indicate that modern constitutional studies are contributing much that is valid and illuminating to man's greatest game: his quest for the truth about himself.

It is being determined, for instance, that all men are no more physiologically alike than they are anatomically, within certain ranges of variation; and that such morphological and physiological variations have much to do with the development of a long list of disease entities to which man is subject, and even, perhaps, with certain criminal tendencies. And even in the field of psychology, where man nearly transcends his human qualities in trying to understand his understanding, much is being ascertained to the effect that as man *is* determined, morpho-physiologically, by combinations

of hereditary and environmental forces, so is he likely, within rather wide limits, to function as a more or less rational—yet always human—animal.

(6) Such is the promise, indeed, of many adequately controlled scientific investigations in the field of constitutional studies, that it would seem logical to advance further the plan advocated by many, of an integrated attack on problems of human constitution as a joint enterprise of scientists trained in anthropology, medicine and psychology, in the form of some closely-knit organization for constitutional research.

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RECENT ADVANCES IN ANTARCTIC BIO-GEOGRAPHY

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IN CONSIDERING the geographic and broad ecological relations of antarctic life, we are confronted at the start with two different practices in the delimitation of the Antarctic zone by recent authors. Since the Antarctic continent at several points extends to the north of the Antarctic circle, it is obvious that the latter cannot serve as a natural zonal boundary. The parallel 60° S. Lat., which touches no land whatever, has long been used as a convenient line between the Antarctic and sub-Antarctic zones, since the lands within this parallel are subjected to the truly continental climate of Antarctica. This is the current practice of authors dealing with terrestrial plants and animals. On the other hand, students of marine life have been impressed by the powerful effect on the distribution of organisms exerted by the hydrologically determined zones of surface water. Such authors use the term "Antarctic zone" to designate a much larger area of sea and land, namely, the whole region south of the Antarctic convergence or northern limit of cold antarctic surface water. This boundary is rather irregular, paralleling neither the continental coast nor any parallel of latitude. By roughly averaging its position around the globe, one finds the average latitude of this convergence is approximately 50° S. Also, at any given longitude the position of the convergence fluctuates considerably in latitude from time to time. The marine organisms of the surface waters change their distributional boundaries accordingly, but the terrestrial floras and faunas do not.

Islands and archipelagos which are characterized throughout an extensive biological literature as typically sub-Antarctic are now found, according to other authors, in the Antarctic zone. Such islands situated south of the Antarctic convergence are Macquarie, South Georgia, and possibly Kerguelen; regarding these, as Rudmose Brown (1928) wrote, "the term 'sub-Antarctic' is justified rather by proximity to the Antarctic rather than by any real approximation to Antarctic conditions."

The difference between the two leading usages of the term "sub-Antarctic" is even greater than that between the definitions of "Antarctic zone." Such ambiguity in bio-geographical nomenclature may be avoided by the use of the classification of life zones herein proposed. Both concepts of the Antarctic zone mentioned above are firmly entrenched in the literature, since both are biologically valid. The names, not the concepts, are at fault. Both concepts have a valid ecological basis because of the great difference in specific heat between water and air, and the recognized distinction between macroclimate and microclimate. We must recognize the disparity between terrestrial and marine habitats in the temperature and other conditions to which organisms are actually subjected during the growing season.

All terrestrial and fresh-water plants and animals which occur south of 60° S. Lat. may be referred to the *Antarctic land province*, dominated by the continental climate of Antarctica. The South Orkney Islands, for example, located just within the boundary, support no vascular plants and no liverworts. The *sub-Antarctic land province* corresponds with Skottsberg's (1905) "*sub-Antarctic vegetation province*," including the Kerguelen district, New Zealand district, sub-Antarctic South America district, and South Georgia district. Referring to the distribution of marine organisms only, the *Antarctic marine zone* is the zone of surface water bounded on the north by the Antarctic convergence, and the surface water zone next to the northward which is bounded on the north by the sub-tropical convergence constitutes the *sub-Antarctic marine zone*.

PHYTOPLANKTON

Plankton plants constitute the organic foundation of the pelagic ecology of the sea. Diatoms are the dominant constituents of the phytoplankton of the southern ocean. Two main diatom floras exist there, a warm-water and a cold-water flora, and the two are in general separated by the sub-tropical convergence. Environmental factors greatly influence the size of the diatom frustule. According to Hendey (1937), the warm-water flora, subjected to a high hydrogen ion concentration and a limited supply of silica, phosphates, and nitrates, is characterized by thin-walled individuals with relatively large cubical capacity and low surface area, tending to approach spherical form. Although in the Antarctic and sub-Antarctic marine zones nutrient salts seldom if ever fall so low as to become a limiting factor to growth, and dissolved CO_2 and O_2 are present in high concentrations, the low temperature and decreased sunlight do not favor large individuals. The size-temperature relation of marine plankton diatoms is thus the reverse of that of many classes of marine animals in which individuals of the same species reach a larger size in colder waters. The decreased size and heavier silicification produces a denser cell, one with a greater mass per unit volume, which necessitates development of a slender cylindrical form and bristly appendages to insure buoyancy. In some genera, the individuals probably have some control over their own buoyancy.

Hendey divides the cold-water flora into an oceanic sub-flora (forms that are constantly free-floating, normally solitary individuals) and a neritic (coastal) sub-flora. Some of the neritic forms are free-floating, but most of them are bottom-dwelling or coast-line species which form groups of many attached individuals. The predominant species obtained from sea ice are truly neritic. The characteristic ice-flora of the Antarctic seems to differ entirely from that of the Arctic not only in specific composition but even in general types of species.

A peculiar diatom population is formed upon the skin of whales in Antarctic waters only. Hart (1935) states that a readily visible diatom film indicates that the whale has been within the Antarctic zone at least one month. The truly oceanic species are entirely absent from the skin flora, the predominant types being stalked and bottom-dwelling diatoms.

Nearly all southern diatom species are tolerant of considerable environmental variation, and therefore have a very wide geographic range. However, circumpolar collections by Hart (1927) have demonstrated that one species (*Rhizosolenia curvata*) constitutes by far the best biological indicator of the southern limit of sub-antarctic surface water. This limit,

the Antarctic convergence, fluctuates considerably; but whenever it was shown hydrologically that the sub-antarctic surface water had been forced southward of its average position, this readily identified diatom was found in the plankton. Its occurrence on the Antarctic side of the convergence is a good indication that mixing is in progress or has very recently taken place, since in the changed environment provided by the mixed water the diatom reproduces by vegetative division only, and cannot long persist.

Diatoms show a striking seasonal variation in abundance in southern waters, the fewest occurring in the winter months June, July, and August. A noticeable increase takes place in October, and during November most southern diatom genera reach their great maxima in the northern part of the antarctic marine zone, and in the southern part of the sub-antarctic marine zone to a less extent.

The most pronounced biological feature of cold seas is the amazing wealth of phytoplankton, as regards individuals rather than species. The numbers of some species often run into millions in a single haul. The explanation usually given is the high concentration of nutrients and gases in these waters. Experiments by Loeb (1908) on larval sea-urchins demonstrated a striking differential, at low temperatures, between the longevity of the individual and the time it requires to attain reproductive maturity. By lowering the temperature 1° C. the duration of life is about doubled, but the period of development is lengthened only very slightly. The organism's reproductive capacity is thus vastly increased, and very many more generations exist simultaneously at the lower temperature. Whether or not this principle is applicable to multicellular zooplankton generally, it cannot be extended to unicellular phytoplankton organisms, and it is the latter group which is chiefly responsible, both directly and indirectly, for the teeming life of polar waters. These plants reproduce both sexually and asexually, and in either method the parental protoplasm is used up. The individual's life span coincides with the generation which it represents, therefore no differential can exist between the pre-reproductive period and individual longevity.

There have been attempts to explain the inverse relation of temperature to plankton production, as well as the apparent effect of melting ice in stimulating production, by reference to the "polymerization" theory of water structure. Barnes (1932), Harvey (1933), and Barnes and Jahn (1933) reported that recently melted water stimulated growth beyond that occurring in ordinary water at equivalent temperatures. This effect would depend on a lag in the attainment of equilibrium in the changed organization of water after a temperature change. Such a lag has not been convincingly demonstrated by physical methods. Moreover, recent work on the internal structure of water by Bernal and Fowler (1933) and Morgan and Warren (1938) makes it difficult to accept the scanty biological evidence for this lag. The problem of the physiological effect of the thermal history of water is reviewed by Barnes (1937). A clear non-technical summary of the theoretical structure of water is presented by Gibson (1938).

With the lowering of the temperature of sea water, its density increases right to the freezing point (about −1.9° C.). Unless the above-mentioned lag can be proven, it would seem impossible to separate experimentally the effect on marine plankton of temperature, density, and molecular orientation of water.

LICHENS

The southernmost known plants are four species of lichens found at the Queen Maud Range in 1934 at 86° 03′ S. Lat., within 237 geographical miles of the pole. Only 32 miles farther north the same party collected six lichen species, and one imperfect fungus. All seven lichen species represented are new to science; four of them are apparently restricted to this Queen Maud locality, but the other three were found also by Siple's (1938) sledging party of the second Byrd Antarctic Expedition. In Marie Byrd Land and King Edward VII Land this party encountered a truly surprising amount of plant life. From the collection, seventy-seven additional new species of lichens were described by Dodge and Baker (1938). The lichens now known from the Antarctic land province number 293 species.

It is significant that all eighty-nine lichen species found by this expedition are endemic to this province. Moreover, Dodge and Baker regard supposed identity of Antarctic species with northern ones as based on uncritical taxonomic work, which would mean that about forty new unnamed species may exist in material already collected.

Although the paucity of endemic genera opposes the view that Antarctic lichens represent an ancient pre-glacial flora, evidence from the composition of the lichen body favors this conclusion. The algae found associated with the fungi in all lichens from continental Antarctica are green algae resembling the familiar *Protococcus*. Such lichens form a much older plant group than those with blue-green algae as symbionts. It is clear that blue-greens can withstand antarctic conditions, since algae of this group were found living independently in the same locality. It is therefore considered possible that an antarctic lichen flora has survived the present glacial period on the continent, the more recently evolved lichens which contain blue-green algae having failed to penetrate there as yet.

Noteworthy differences are found between temperate zone lichens and Antarctic species of the same genera. In the latter the algal cells are much less abundant, and often occur more or less scattered throughout the medulla rather than organized in a definite layer below the cortex. Also the whole thallus, according to Siple (1938) is greatly reduced in proportion to the fruiting structures, and the plants are usually dark colored, resulting in readier absorption of the sun's heat.

Evidence from the work of Stuckey and Curtis (1938) and others on higher plants indicates that freezing temperatures cause the death of plant tissues by mechanical injury resulting from ice formation within the cytoplasm, rather than by desiccation or other causes. Anything that will decrease the amount of free water within the cell at the time of freezing seems to lessen the possibilities of ice formation. Physiological studies of Antarctic lichens in their resistance to freezing would be of much interest. Pending such work, we may speculate on their remarkable resistance by analogy with other plants. It is known that only free water freezes in plants; bound water can not form ice. When lichens are not snow-covered, the very low absolute humidity of cold antarctic winds may cause rather thorough drying of the plants, plasmolyzing the cells and reducing the free water to a minimum. Lichens contain large amounts of lichenin and other dextrosans. These colloidal hemicelluloses swell readily in water, so that by imbibing and binding the free water and thus greatly increasing the osmotic concentration in the vacuole

these substances may prevent the formation of ice within the cells.

As evidence of the extreme slowness of lichen growth at Graham Land, Bertram (1938) points out that the lichens on the stones of a cairn built by Charcot in 1909 still retained their original orientation in 1935.

Much more collecting must be carried on by trail parties before a satisfactory understanding of plant distribution on the Antarctic continent can be gained. In the past nearly all sledging parties have missed all but the most conspicuous plants. Most lichens masquerade as minute crumbs of dirt on rocks. Many tiny forms are bud-like in shape, resembling succulents; others, almost microscopic in size, are wedged in the intercrystal cracks of rocks. The fact that most of the mountains Siple studied had species apparently restricted to them strongly suggests that many more new species await discovery by careful search of the hundreds of coastal peaks as yet unvisited. Even the Queen Maud Range fringing the polar plateau, practically untouched by lichen-conscious sledgers, may be expected to yield new species and extension of range of known forms.

BRYOPHYTES

Seventy-three species of mosses occur in the Antarctic land province, thirty of them being endemic there. Mosses have been found only to 78° S. Lat., and at this latitude only in South Victoria Land. Graham Land supports a much richer bryophyte flora. Between these regions, in Marie Byrd Land, five species have recently been collected. Two of these extend to both Graham Land and South Victoria Land, but the dominant moss of Marie Byrd Land is found in Graham Land and not South Victoria Land. The two remaining mosses were described by Bartram (1938) as new species.

The Argentine Islands off Graham Land constitute the richest area botanically in the Antarctic land province. On sheltered inshore islands at about 68° S. Lat., Bertram (1938) studied patches of a closed moss association up to an acre in extent which had produced a peat as much as three feet in thickness.

Six species of hepatics grow south of the sixtieth parallel.

VASCULAR PLANTS

The New Zealand Sub-Antarctic Islands possess 88 genera of vascular plants, 56 of which are represented in Fuegia also. Such striking floristic affinities between sub-Antarctic America and the New Zealand region have led botanists to support the idea of a former Antarctic center of plant distribution. They picture an early Tertiary Antarctic flora pushing northward along both sides of the Pacific, utilizing on the east a land bridge or chain of islands between Graham Land and Fuegia, and on the west a hypothetical "Greater New Zealand" which approached Antarctica sufficiently for ready transfer. Subsequent glacierization destroyed all the higher vegetation of the continent, and that of the sub-Antarctic land province except for a few species. The sources of repopulation were Fuegia and New Zealand. The latter supplied the major part of the flora now found in the New Zealand Sub-Antarctic Islands, which in turn largely restocked Macquarie Island. About 18 species are to-day more or less circumpolar in the sub-Antarctic land province, and three of these are truly circumpolar, occurring on almost all the sub-Antarctic islands. Only two flowering plants grow within the Antarctic Circle (or even south of 60° S. Lat.),

whereas Hooker (1861) listed 762 species within the Arctic Circle.

Skottsberg (1936) has called attention to the striking distribution of a few genera from the original Antarctic center which are now represented by geographically isolated species in Polynesia. The affinities of such species in Hawaii are not with south-western Pacific plants, but with those of sub-Antarctic and temperate South America.

The plant geography of the south-western Pacific in relation to the theory of continental drift is discussed by Diels (1936), who finds several genera and species of relatively recent Antarctic origin occurring in the south-eastern part of Australia. A more important element in Australia's flora is of much older standing there, comprising ancient types lacking Antarctic affinities. A third element is so related to Malaysia that interchange from early times is apparent. These facts are all contrary to the principal assumption of Wegener's hypothesis: that Australia drifted to the north quite recently and approached south-eastern Asia.

MARINE INVERTEBRATES

The main features of Antarctic zooplankton are summarized by Hardy and Gunther (1935) as follows: (1) the small number of species inhabiting the surface layer, i.e., the top 150 meters, the species which do so being very prolific; (2) the lack of pelagic larval stages of benthic animals; (3) the absence of a daylight surface fauna; (4) the importance of vertical migration.

The latter point requires some explanation. Since plankton organisms are unable to control their distribution by actively swimming against ocean currents, how do species characterizing different regions maintain their normal ranges in spite of constantly changing waters? During two years on the ship *Discovery II*, Mackintosh (1937) investigated this question in the eastern Pacific. He learned that the three most important zooplankton species perform an annual vertical migration, drifting northward in the surface water in summer, and descending to very deep southward-flowing water in winter. The vertical range is from 400 to 600 meters and the horizontal range some hundreds of miles. This is held to be the normal and general means by which ranges are maintained in the higher latitudes of the southern ocean.

Ecologically the most important animal in the Antarctic marine zone is an opossum shrimp, *Euphausia superba*. Its food consists very largely if not entirely of diatoms and other plankton plants. In contrast to a one-year period in other euphausians whose life history is known, the developmental period in this species is two years. The wide range of time within which older forms are found is important, Fraser (1936) points out, in insuring a constant supply of food for whale-bone whales in the south. Continued abundance of the species in the far south is attributed to a rotary movement resulting from the concentration of the earlier developmental stages in the southward-flowing warm deep water, and that of the later stages in the northward-flowing Antarctic surface water. Thus the stock of adolescents at the edge of the fast ice is constantly replenished.

The Antarctic and sub-Antarctic Echinoderm fauna is extremely rich, far exceeding that of the Arctic and sub-Arctic regions. We are still far from a satisfactory knowledge of the species, much less their biology and distribution. Investigation of the almost unknown ocean floor of the far southern Pacific is particularly needed.

Burton (1932) refers to the belief among geologists that the growth of sponges is most prolific in warm seas, and that a deposit rich in sponge remains must therefore have been laid down in a warm sea. He proves by the present abundance of living sponges in Antarctic waters that this is not the case in recent times. Sponges are at least as abundant, and probably more so, in the Antarctic as in the West Indies, Australia, or the Indian Ocean. Even more important geologically is the fact that sponges of colder waters are almost exclusively siliceous and hence favorable for fossil formation, while the soft spongin material of a large percentage of warm-sea sponges is unlikely to be preserved.

That sponges reached their maximum development in the Cretaceous period is another belief for which evidence is lacking. Neither in the complexity of the skeleton, the size of the spicules, the size of individual sponges, nor in the diversity of species did the Cretaceous fauna surpass the development of present Antarctic sponges or those of any other quarter of the globe.

Turning to the unicellular forms, one finds the Antarctic Foraminifera limited in both genera and species and primitive in character. Earland (1934) stresses the similarity of this fauna to that of the deep sea in all latitudes. Many species in the Antarctic are truly cosmopolitan; others are closely allied to deep-sea forms, having probably migrated from the depths of the adjacent oceans.

After reviewing the evidence bearing on the theory of bipolarity, Murphy (1928) concludes that the theory can no longer be accepted in its broad and naïve sense. He raises the question whether the inconclusive data may not support equally well the converse theory of an earlier universal cold sea rather than a universal warm one that has since cooled at the poles.

TERRESTRIAL INVERTEBRATES

The largest permanent inhabitant of the Antarctic land province is the wingless fly *Belgica*, about five millimeters in length. Several protozoans, sixteen species of rotifers and the same number of tardigrades, two fresh-water crustaceans, mites, and at least 18 species of insects comprise the known fauna. The insect orders represented are the Collembola, Corrodentia, Mallophaga, Anoplura, and Diptera.

A sledging party sent by Byrd into Marie Byrd Land found that the distinct pink color of a mucky pond bottom was due to a profusion of brilliantly red rotifers. Upon thawing of ice in which tardigrades and rotifers had been frozen, probably for some years, these creatures suddenly resumed activity.

The recent British Graham Land Expedition reports (Bertram, 1938) the first species of copepod (water flea) discovered in Antarctica.

Davies (1935) maintains that the Collembola, being primitively wingless insects, constitute better material for the study of geographic distribution than any other insect order, because migration by flight is impossible and the delicate integument makes it very unlikely that they could be carried any appreciable distance by the sea. There are at least 11 species in the Antarctic land province, representing 9 genera. The genus *Cryptopygus* includes only three species; one is Fuegian, a second is Antarctic and sub-Antarctic in the Scotia Arc, and a new species has been described from New Zealand. This genus thus furnishes probably valid evidence of former land connections. However, since Collembola are usually associated with penguin rookeries

and beaches frequented by penguins, it is at least conceivable that the insects may be transported beneath the waterproof feather coat of these widely wandering birds.

VERTEBRATES

Five families of Antarctic and sub-Antarctic fishes are important in the Patagonian region, together constituting one of three categories of Patagonian coastal fishes (Norman, 1937). One species of the family Nototheniidae ranges from Graham Land northward up the coast of Argentina to the Rio Plata. However, the characteristic Antarctic genera, *Pleuragramma* and *Trematomus*, do not reach Patagonia.

In defining the austral fish regions, Regan (1914) added confusion to zonal concepts by adoption of the mean annual surface isotherm of 6° C. as the northern limit of the Antarctic zone, thus including the Kerguelen district (the Kerguelen, Prince Edward, Crozet, Marion, and Heard Island groups) within this zone. Norman (1937) has shown that the dissimilarity between the Patagonian region and the Kerguelen district is less marked than Regan believed, and has pointed out several features which the areas have in common. It should be remembered that most islands of the Kerguelen district are well to the north of the Antarctic convergence, and all of them are a considerable distance north of the sixtieth parallel. The Kerguelen district should be considered sub-Antarctic not only regarding the land biota, but those of its islands lying between the Antarctic and sub-tropical convergences must also be washed by waters of the *sub-Antarctic* marine zone.

Although Macquarie Island lies south of the surface isotherm of 6° C., Regan admits it to the sub-Antarctic zone on evidence from fish distribution. This island is decidedly sub-Antarctic in its terrestrial aspects, although it lies a little to the south of the Antarctic convergence. Since the 6° C. isotherm as the northward boundary of the zone of Antarctic coastal fishes breaks down in the important instances of Macquarie Island and the Kerguelen district, it is unsatisfactory as a zonal boundary.

Murphy (1936) has amassed abundant evidence in support of the thesis that ecologically oceanic birds are primarily aquatic rather than aerial organisms, and that their distribution is controlled by oceanographic factors. The birds of the southern oceans, therefore, can be understood only in relation to the zones of surface water. They must be considered, together with other marine organisms, as subject to the zonal bounds of the convergences rather than to the control of the climate of continental Antarctica, and consequently belong in the marine zones rather than the land provinces.

Few Antarctic birds are even reasonably well known from the standpoint of detailed life-history and behavior. The Adelie Penguin remains the best known scientifically as well as popularly. The four birds that breed farthest south are the Emperor Penguin, Adelie Penguin, MacCormack's Skua, and Snow Petrel. The Skua wanders farthest inland; the southernmost record was an individual that visited Captain Scott during his last journey, at a point on the polar plateau 560 geographical miles from the sea and only 160 miles from the pole, at an elevation of 9,980 feet. Murphy lists fifteen birds as typical of the Antarctic (marine) zone: four penguins, two albatrosses, eight petrels, and one skua. A Snow Petrel rookery reported by Siple and Lindsey (1937) from King Edward VII Land advanced the known breeding range

of this species 400 geographical miles to the south.

Murphy (1936) casts serious doubt on the oft-cited 22,000 mile annual migration of the Arctic Tern, which is supposed to regularly cross the Antarctic Circle and sometimes reach 74° S. Lat. A few specimens have been taken near the Antarctic Circle in the Weddell Sea and Pacific, but the normal winter range appears to be the Pacific off the coasts of Peru and Chile, and similar latitudes in the Atlantic. Most alleged Antarctic occurrences of the Arctic Tern are based on sight records, which are valueless because this bird is not distinguishable in the field from the Antarctic Tern (*Sterna vittata*). The suggestion that the latter bird is masquerading generally in ornithological literature as the Arctic Tern may well prove correct when adequate bird collections from Antarctic waters have ultimately been built up.

Four species of seals have a circumpolar distribution in the Antarctic marine zone. The Ross seal is so rare that probably fewer than fifty individuals have ever been seen. The sea leopard is a solitary wanderer that feeds largely on penguins. In this species the females attain a larger size than the males, which seems to be true, although to a less degree, of the Weddell seal also. The crab-eater is a slender, agile seal inhabiting the pack ice chiefly. Lindsey (1938) found that a female of this species when barely two years old may give birth to its first young. In locomotion on snow-covered sea ice, crab-eaters about four months old show remarkable speed and endurance. Often a man running at top speed cannot keep pace with the seal as it strikes the hard-packed snow with tremendous blows of the hind flippers held together vertically like a caudal fin.

Of the four Antarctic seals, only the Weddell is well known as regards habits and life history (Lindsey, 1937). When a female has just turned three years of age her first pup may be born. The average pup is 34 days old when the full set of teeth appears, and it depends on the mother's milk for 48 days after birth. This offers a marked contrast to the crab-eater seal, which has been reported to possess perfectly functional teeth at birth and to separate from the mother two or three days after birth. Young Weddell seals average 64 pounds at birth, and, feeding exclusively on mother's milk, several averaged seven pounds gain in weight *daily* for seven consecutive days or longer. This is the southernmost mammal, and is found throughout the year at the extreme southern limits of its range. In winter its layer of blubber reaches four inches in thickness. The animal remains at this season beneath the new ice, through which it maintains breathing holes by sawing ice by means of the strong canine teeth. In this process the head is swung from side to side with the mouth opened to a 150 degree angle. Feeding on fish secured in the watery darkness beneath eight or ten feet of ice, this seal, alone among mammals, withstands the rigors of the four sunless months at 78° S. Lat.

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NEW BIOLOGICAL BOOKS

The aim of this department is to give the reader brief indications of the character, the content, and the value of new books in the various fields of Biology. In addition there will frequently appear one longer critical review of a book of special significance. Authors and publishers of biological books should bear in mind that THE QUARTERLY REVIEW OF BIOLOGY *can notice in this department only such books as come to the office of the editor. The absence of a book, therefore, from the following and subsequent lists only means that we have not received it. All material for notice in this department should be addressed to Dr. Raymond Pearl, Editor of* THE QUARTERLY REVIEW OF BIOLOGY, *1901 East Madison Street, Baltimore, Maryland, U. S. A.*

BRIEF NOTICES

EVOLUTION

THE NEW SYSTEMATICS.
Edited by Julian Huxley. Oxford University Press, New York; The Clarendon Press, Oxford. $6.00. 8½ x 5½; viii + 583; 1940.

This is a book that systematic biology has been waiting for ever since the doctrine of evolution received general acceptance. Previous to that time taxonomic systems were not based on real relationships, for no one believed that any real relationship existed. But with the coming of evolution the need for a phylogenetic classification has become obvious. Yet the old time taxonomic systems have been strangely little disturbed by the new light that has been shed on phylogenetic relationships by modern research.

One reason for this is the natural reticence of any investigator to set up a system of taxonomy that may have to be discarded next week because another observer has demonstrated a new truth of nature inconsistent with it. In the old days when all systems were equally logical, and the only criterion for value was convenience there was no objection to every systematist having his own peculiar systematics, as the differences among the taxonomies of Linnaeus, Duvier, and Lamarck testify. Another reason is that most modern biologists are specialists in a limited taxonomic field, in which those modifications relied upon for classificatory discrimination appear (to them) much larger than equivalent modifications in other fields.

The present work is a symposium by twenty-two European biologists and one American, all of whom endeavor to record their beliefs as to what shall be the guiding principles of the new taxonomy. That they consulted each other is clear from the numerous references in each essay to the other essays in the volume, but they have not arrived at any agreement among themselves as to what constitutes a taxonomic group, or how taxonomic groups arrive. For instance, one of the collaborators, Lancelot Hogben, has contributed a very thought-provoking chapter in which, with characteristic iconoclasm, he reproves Darwin for not having named his work "The Origins of Species." The process of speciation comes about as the result of the interaction of numerous factors, and if the combination of factors occurs more than once a species may have a multiple origin.

This point is brought up by W. J. Arkell and J. A. Moy-Thomas who refer to the genus *Gryphaea* which occurs in the Cretaceous and the Tertiary, in three different horizons which alternate with others in which it is absent. But these authors make it clear that while the genus has thus originated several times it has only had one origin—it is a modified *Ostrea*, and this latter genus has retained

as a generic characteristic the ability to produce forms resembling *Gryphaea* even to the present day, for there is a recent *Ostrea* in the collection of Stanford University that no paleontologist would hesitate to assign to *Gryphaea* if it had been recovered from a Tertiary horizon.

The laboratory worker who is privileged to see how variation takes place under controlled conditions is likely to have ideas of his own, and the present reviewer finds it difficult to refrain from interspersing his own thoughts into this review. Perhaps that has been one object of the collaborators who have produced the book—to stimulate thought. It is unbelievable that any one could read such a work and not emerge from the experience with his mind clarified and stimulated for further research. The ample bibliographies at the end of each chapter are most helpful, as is also the index which covers seventeen pages of fine print.

The reviewer finds it impossible to compare the essays in this work on the basis of relative merit. They are all good. About all he feels justified in saying is that he found those by C. Diver and J. R. De Beer the most interesting, that by H. J. Muller the most informative, and that by J. S. L. Gilmour likely to have the widest appeal. But they are all good and well worthy of inclusion in such a symposium.

THE MATERIAL BASIS OF EVOLUTION.
By Richard Goldschmidt. Yale University Press, New Haven; Oxford University Press, London. $5.00. 9 x 6; xi + 436; 1940.

The Silliman Foundation at Yale University was established for the purpose of organizing an annual course of lectures designed "to illustrate the presence and providence, the wisdom and goodness of God, as manifested in the natural and moral world." It was further directed that each annual course should be made the basis of a volume to form part of the series constituting a memorial to Mrs. Silliman. The present volume is the published form of the 1939 Silliman lectures.

The first point in the author's discussion of the problem of evolution is an attack on the neo-Darwinian thesis; a thesis which holds to the idea that abrupt changes, or mutations of the hereditary determiners (the genes) are the starting point for evolution; and that the accumulation of mutations, their isolation and selection in the new variants—which are themselves capable of transmitting the new characters, as well as of producing new ones by the same process—account for all evolutionary divergencies. Goldschmidt's criticism of this theory is that it must accept the fact that somehow new genes are formed, since it is unlikely that man and amoeba are connected by mutations of the same original genes. He believes that a sounder thesis of evolution can be based on the combined workings of what he has termed micro- and macro-evolution. Micro-evolution within the species is the process of the accumulation, selection, and adaptation of minute (micro) mutations. Micro-evolution produces changes which *never transcend* the confines of the species, hence the typical products of micro-evolution—the geographic races—can never be considered incipient species. On the other hand, species, genera, families, and the higher categories of classification originate in single macro-evolutionary steps as completely new genetic systems.

The mass of well-organized, analyzed and synthesized research work presented in this volume should be an inspiration to any college student, who, by the way, will find here a new and stimulating thesis upon which to build his knowledge of evolution, and one which should be studied carefully in the light of the neo-Darwinian theory, as well as the theory of the gene.

The text is beautifully illustrated, completely indexed, and has a bibliography of some 400 titles.

MANKIND IN THE MAKING.
By M. Cathcart Borer. Frederick Warne and Co., London and New York. $1.50. 7¼ x 5¼; [6] + 152 + 8 plates; 1939.

This most interesting volume is an accu-

rate and fascinating chronicle of the past history of *Homo sapiens*, written by one who has a knack, not only of being informative, but also of encouraging a desire for further information among his readers. The book starts out with the beginning of things and discusses in order: the ancestors of man, the great ice age and the men of that era, the men who came after the ice age, the old stone age, the middle stone age, and concludes with an exhilarating report on the neolithic period. There is neither an index nor a bibliography, but the book is well illustrated with beautiful color plates and line drawings.

GENETICS

MAMMALIAN GENETICS.

By William E. Castle. Harvard University Press, Cambridge; Oxford University Press, London. $2.00. 9 x 6. viii + 169 + 40 plates; 1940.

Mammalian Genetics is intended for use in introductory courses in genetics—preferably the Senior High School or Junior College level. The material of the text is organized in conformity with the more recent and so-called better pedagogical trend of leading from the familiar to the unfamiliar; from the known to the unknown; and from the general to the specific.

The idea of inducting college freshmen into genetics via Mammalia (since the freshman himself is a mammal, and presumably will want to know something of his own inheritance as well as that of our domestic animals) is a noble one, but in view of the considerations of time, expense, and simplicity of form, this reviewer still believes that *Drosophila* provides the best route for elementary work in genetics. Even though a student has seen more, and is more familiar with rabbits, cows, and mice than *Drosophila*, it is almost a certainty that he will know little or no more of the genetics of the mammals than of *Drosophila;* and it is equally a certainty that he can learn, by experimentation, the genetics of the latter much more quickly than that of the former.

The early chapters of the book present a very elementary treatment of the laws of Mendelian inheritance, linkage, and crossing-over, as demonstrated by the guinea pig, rabbit, rat, and mouse. *Drosophila* is used to demonstrate sex-linked inheritance. The later chapters deal with the inheritance of blood groups in rabbits and man, and the more common mutations among our domestic animals.

A short bibliography is appended to each chapter of the text, and there is a short table of contents and an index.

BREEDING AND MANAGEMENT OF LIVE STOCK (*Cattle, Horses and Pigs*). *Together with a Section on Pig Farming. Second Revised Edition.*

By A. W. G. Lipscomb. Section on Pig Farming written in association with F. Discombe. Whitcombe and Tombs, Wellington, London, Melbourne and Sydney. 7s. 6d. net. 7¼ x 5; 362; 1940.

The scientific breeding and care of live stock is one answer to the growing demand for domestic animal products by the ever-increasing world population. To meet the need for a text which would outline the most recent advances in this phase of agriculture, Lipscomb compiled this volume. It contains a wealth of information for farmers, students of agriculture, and anyone else who is interested in the status and welfare of the domestic animals. The subject of sheep farming, which has been adequately treated in other volumes, is not included. The statistics and records, which in this edition have been completely brought up to date, are drawn largely from Australian and New Zealand sources, but there is much material that is applicable to animal husbandry in any corner of the globe. The text is supplied with a useful gestation table for mares, cows, ewes, and sows; a complete index; and numerous well-chosen illustrations.

GENERAL BIOLOGY

WHERE IS THE —— COLLECTION? *An account of the various Natural History Collections which have come under the notice of the compiler between 1880 and 1939.*

Compiled by Charles Davies Sherborn. The University Press, Cambridge; The Macmillan Co., New York. 90 cents. 8½ x 5½; 149; 1940 (paper).

Very few natural history collections survive the original collector. Either they are purchased by dealers who break them up for sale in small lots or they lose their identity by being absorbed by larger collections in museums. The difficulty of tracing types is manifest.

The author of the present work has compiled all the available data concerning those collections that have so disappeared during the past sixty years. One would think that a catalog of such nature would be extremely dry reading, yet those who read between the lines will find elements of both pathos and humor. For instance in it we can read of John Phillips who took his fossils to London, where they were stolen the first night by burglars, who mistook them for plate, and who, on learning of their error, threw the whole collection into the Thames from Blackfriar's Bridge: also of Charles Ottley Groom, Duke of Mantua and Monteferrat, Prince of Mantua and of the House of David, who was a notorious rogue and thief and who tried to kill Thomas Davies by dropping a boulder upon him from a high ladder in Tennant's shop in the Strand.

The work is not infallible—it puts Isaac Lea's collection of *Unionidae* in the American Museum in New York instead of the National Museum in Washington. And of course it makes no pretension of completeness—the magnitude of such a task would preclude its achievement.

LABORATORY MANUAL OF GENERAL BIOLOGY. *I. Botany. II. Invertebrate Zoology. III. Vertebrate Zoology. Fourth Edition.*

By John G. Arnold, Jr., and Timothy L. Duggan. C. V. Mosby Co., St. Louis, Mo. $1.50. 10½ x 7¾; 275; 1940 (paper).

LABORATORY DIRECTIONS FOR GENERAL BIOLOGY. *Third Edition.*

By Arthur W. Haupt. McGraw-Hill Book Co., New York and London. $1.00. 9 x 6; ix + 65; 1940.

The first of these manuals, on loose sheets, is based on work covered in a general biology course at Loyola University of the South, New Orleans. The second covers the general biology course at the University of California, Los Angeles. Both are designed to supplement lectures and are arranged in the form of exercises. The first guide, which covers a more extensive course than the second, is intended to acquaint the student with the external and internal structure of a large number of plant and animal types; the second, which is arranged for a class meeting twice a week in one semester, tends to emphasize, in a general way, the underlying principles of the subject.

DOWN TO EARTH. *A Naturalist Looks About.*

By Alan Devoe. Illustrated by Gertrude M. Bradley and D. F. L. Bradley. Coward-McCann, Inc., New York. $2.50. 8 x 5½; x + 228; 1940.

A collection of brief essays such as most newspaper columnists affect, but from which they differ, chiefly in being more meritorious. They are excellent propaganda for sanity in living. Unfortunately, only a comparatively small proportion of the population is likely to read this book at all, and of these the reviewer fears that but few will undergo a change of conviction as a result. For every citizen like Mr. Devoe there may be several thousand "brave men of Brielle" and it is the latter who get into politics, who mold public opinion and who direct national policy. Is it surprising that the times seem out of joint?

The reviewer would like to see this book used as course reading in the secondary schools of the nation. It would be a great improvement over the anaemic imitations of natural history that served his generation.

VERITÀ BIOLOGICHE NEL PENSIERO DI SCHOPENHAUER.

By Mario F. Canella. Nicola Zanichelli Editore, Bologna. L. 5. 9½ x 6½; 16; 1938 (paper).

In this pamphlet the author argues that

there is much in the philosophical works of Schopenhauer—much more than in Plato's idealism and Kant's criticism—of fundamental interest to biologists, particularly in his concepts concerning the "will to live." In fact he concludes that the "philosophic system of Schopenhauer is the only one which can lead him [the biologist] 'as far as the solid ground of reality.' "

This is a reprint from the *Fünfundzwanzigstes Jahrbuch der Schopenhauer-Gesellschaft* (Carl Winter, Heidelberg) and the *Rivista di Psicologia*, Anno 34, Fasc. 1, both published in 1938.

BIOLOGICAL SURVEY OF THE CONNECTICUT WATERSHED. *Survey Report No. 4.*

By Herbert E. Warfel. State of New Hampshire, Department of Fish and Game, Concord. $1.00. 12 x 9⅛; 256 + 3 maps; 1939 (paper).

This fine report of the New Hampshire Biological Survey is a compilation of the data collected during the summer of 1939 and is dedicated to the memory of Earl E. Hoover (1911–1939). It is the fourth and final report of a series, the first three of which were contributed by Hoover. The report includes stocking records and policies for the streams and lakes (data arranged on master sheets, 50 pages for streams, 25 pages for lakes), geology, physical and chemical data, description of fishes, plankton, amphibians and reptiles, amphibian larvae, and freshwater shells, with locality charts, etc. Also included are many illustrations, plates, and charts, and three large contour maps in a folder attached to the back cover.

THE AIR AND ITS MYSTERIES.

By C. M. Botley. American Edition Arranged by Hanor A. Webb. With a Foreword by Sir Richard Gregory. D. Appleton-Century Co., New York and London. $3.00. 8 x 5¼; xv + 302; 1940.

To the amateur weather forecaster and others with a casual curiosity about the atmosphere this book will prove instructive. Much of the material, however, is written in an overly simple style, and the facts and principles given are well known to anyone with a moderate understanding of physics. The early pages deal with the composition and pressure of the air and the tricks of the wind. Additional facts are given concerning clouds, precipitation, climate, and weather forecasting. Sound and light are likewise discussed, while the final chapters are devoted to the importance of weather conditions and the stratosphere in aviation and radio transmission. Numerous diagrams accompany the text and there is an adequate index.

BIOLOGICAL SYMPOSIA.

Edited by Jaques Cattell. With a Foreword by Albert F. Blakeslee. The Jaques Cattell Press, Lancaster, Pa. $2.50. 9⅝ x 6¾; vii + 238; 1940.

Containing papers by many of the leading American men of science, the material embodied herein is divided into three parts: the cell theory, mating types and their interactions in the ciliate infusoria, the chromosome structure. The various papers were originally presented at the 1938 meeting of the American Association for the Advancement of Science, in Richmond, Va., and are here brought together in permanent form. They comprise a related series of observations on an important theme. Each paper has its individual bibliography but there is no index.

FUNDAMENTALS OF BIOLOGY. *Third Edition.*

By Arthur W. Haupt. McGraw-Hill Book Co., New York and London. $3.00. 9 x 6; xii + 443; 1940.

The third edition of this book follows the same conservative presentation as is found in the second edition (Q.R.B., Vol. 8, No. 2, 1932). Much new material relating to the human body and to the subject of immunity to disease has been added. Chapters on vitamins and hormones have been greatly expanded. There are also 80 new cuts.

HUMAN BIOLOGY

THE NATIVE RACES OF ASIA AND EUROPE. *Anthologia Anthropologica. A Copious Selection of Passages for the Study of Social Anthropology from the Manuscript Notebooks of Sir James George Frazer.*

Arranged and Edited by Robert A. Downie. Percy Lund Humphries and Co., London. 35 s. 11 x 8½; vi + 399; 1939.

THE NATIVE RACES OF AMERICA. *Anthologia Anthropologica. A Copious Selection of Passages for the Study of Social Anthropology from the Manuscript Notebooks of Sir James George Frazer.*

Arranged and Edited by Robert A. Downie. Percy Lund Humphries and Co., London. 35s. net. 11 x 8½; ix + 351; 1939.

These two volumes complete the publication of the material which Sir James Frazer has collected in his notebooks over a long period of research in social anthropology (for the two earlier volumes, cf. Q.R.B., Vol. 14, p. 353; Vol. 15, p. 85). The four volumes represent, in general, left-over material; that is, material that did not exactly fit in with the author's writings, yet was far too valuable to be discarded since frequently it was from sources that are not now easily available to the student. To Mr. Robert A. Downie fell the task of putting these miscellaneous notes into usable form. This he has done in a most competent and satisfactory manner.

All four volumes follow the same plan. A hasty glance through the table of contents will inform the reader whether a particular group is mentioned; or, in the index will be found a careful array of the subjects noted. The first of the present volumes, *Native Races of Asia and Europe* has the following main divisions: Indo-China, Tibet and China, Korea and Japan, Northern Asia, India, South-Western Asia, and Europe—each of these being subdivided. *Native Races of America* is divided into Greenland and North America, Mexico and Central America, and South America, with sub-divisions. The extracts, in English, German, French, or Spanish, are largely from nineteenth century writings, especially for the American volume, but there is also a goodly sprinkling of material from earlier periods. Among these we note Martini Cromeri, *Lithuania*, 1568; Thevenot's *Relations des Divers Voyages curieux*, Paris, 1672; Thomas Hyde, *Historia religionis veterum Persarum eorumque Magorum*, 1700; Petri de Dusburg, *Chronicon Prussiae*, 1679; Antoine Biet, *l'Isle de Cayenne*, 1664; Pablo Joseph de Arriaga, *Extirpacion de la Idolatria del Piru*, 1621, etc. Catholic priests, officers of foreign expeditions, anthropologists, missionaries and travelers have all contributed in their writings to these interesting notes. An excellent outline map for each continent shows the localities of the races mentioned.

HISTORICAL TABLES.

By S. H. Steinberg. With a Foreword by G. P. Gooch. The Macmillan Co., New York and London. $3.50. 9¾ x 7½; x + 256; 1939.

A thorough and scholarly chronology covering a span of approximately 2000 years from 58 B.C., three years before Caesar first invaded Britain, down to the end of 1938, just 8 months short of the beginning of World War II and Hitler's attempt to repeat Caesar's performance. The arrangement is in six columns to the double page (except for the period of World War I). In general the three columns on each left-hand page deal chiefly with the relations of the Powers. The right-hand pages are, in the author's words, "given to what may be described as home affairs and the history of civilization; i.e. constitutional, economic, spiritual, and intellectual activities."

Relative to scientific matters the chronology gives a considerably larger proportion of details for applied than for pure science, which is perhaps natural considering the purpose of the whole work. But few events in the history of pure science of really major importance appear to have been omitted. The compactness of the book, coupled with the easy secular comparability afforded by the columnar arrangement make it one of the most useful books of its kind that has appeared. Every scholar, regardless of his field, will welcome it as a desk companion.

This volume, in common with most

tabular chronologies, is not indexed. This is a mistaken policy. The value and usefulness of the book would be increased many times over if it contained detailed author and subject indexes. This would be true even if the thickness of the volume were doubled, which it would not be. Suppose, for example, one has forgotten the year when Newton's *Optics* appeared, and wants to look it up. This, and other unindexed chronologies, leave one no resource except to run down the appropriate column, beginning say in the middle of the 17th century, until the desired entry is reached.

But even with this defect *Historical Tables* is a work of great value.

THE SWAZI: *An Ethnographic Account of the Natives of the Swaziland Protectorate.*

By Brian A. Marwick. The Macmillan Co., New York; The University Press, Cambridge. $4.25. 8½ x 5½; xvii + 320 + 8 plates; 1940.

This, the first comprehensive work on the Swazi, includes descriptions of their social organization, social and economic life, religion and magic, political organization and legal system, and effects of European contact. The information incorporated in this valuable and very readable treatise was obtained from the author's nine years' experience in Swaziland as a government official, his visits to the native villages, and from the scanty literature on the subject.

That the Swazi culture remains a working whole in spite of the influence of European civilization is evident from the fact that "sanctions and institutions which existed prior to European influence still operate even where attempts have been made to uproot certain elements of culture," and frequent examples occur where Christian converts hurry to consult witch doctors as soon as trouble comes their way. In fact attempts by missionaries and officials to eradicate certain elements of native culture have often not brought the results desired.

Missionaries have insisted upon monogamy with the result that polygamy is becoming discountenanced. The woman who would have been content to become the wife of a polygamist now occasionally refuses to do so, but not infrequently becomes a prostitute or a concubine instead, since there are few occupations by which a native woman can earn her own living. The net result is that a woman who would have been accepted in society as a useful and respected social and economic unit is despised by the conservative natives and by the missionaries if she falls into loose ways as a result of the modification of the outlook upon polygamy.

Appendix I presents the results of studies by other authors which were published after the present book was written; Appendix II is a glossary of Swazi terms used in the text. Annotations and an index have been provided, and the illustrations consist of photographs and diagrams.

WESTWARD FROM VINLAND. *An Account of Norse Discoveries and Explorations in America 982–1362.*

By Hjalmar R. Holand. Duell, Sloan and Pearce, New York. $3.00. 8½ x 5¾; x + 354 + 31 plates; 1940.

When Holand published *The Kensington Stone* some years ago, it became inevitable that some day a larger volume would be undertaken, to which wider circulation should be given.

The objectives of the present work are threefold—to write briefly the history of the Norse settlements on Greenland as far as it has a bearing on the possible colonization of America; to prove the authenticity of the Kensington Stone; and to speculate as to the origin of the Mandans—that peculiar tribe of blond Indians who lived in frame houses and engaged in agriculture. The first two of these involved extensive traveling not only in Scandinavia, but throughout Europe, to examine artifacts in museums and documents in libraries.

Unfortunately, the urge that drove him to add the chapter about the Mandans appears all through the remainder of the book. The entirely unnecessary and irrelevant speculations in which the author enjoys indulging do not impair the validity of the conclusions he reaches, but neither do they add anything, and they are likely to exhaust the reader's patience. If the reader can manage to forget these speculations and concentrate his attention entirely

on the facts, he is likely to conclude, as the present reviewer has done, that Holand has proved his point; but it is a mystery that, after devoting over a quarter of a century to the search for facts in support of his theory, he is unwilling to let those facts speak for themselves.

The book is thoroughly documented with footnotes, but the lengthy bibliography in the earlier work has been omitted. The book is excellently illustrated with photographs, drawings, diagrams, and maps. There is an index of nineteen pages.

ÉTUDE SOCIALE COMPARÉE DES RÉGIMES DE LIBERTÉ ET DES RÉGIMES AUTORITAIRES. (*Essai d'Économie Sociale Comparée.*)

By Jean Lescure. Les Éditions Domat-Montchrestien, Paris. 80 francs. 9 x 5½; 479 + 1 folding chart; 1940 (paper).

The author discusses in detail the philosophy and theoretical principles underlying the political economy of Russia, Germany, and Italy, and examines the results of the attempts made to develop the economic life of these countries according to the political and social ideologies. As is known, in the totalitarian states mentioned the government exercises either directly or indirectly a preponderant control over both capital and labor. The degree and manner of this control differ in the three countries, being most comprehensive in Russia and the least in Italy. The major and more important portion of this book is dedicated to a delineation of these differences. The clearness with which the distinctive and differentiating elements of these doctrines are outlined is remarkable and makes this book a first class contribution to economic and social literature and one especially to be read by those who speak glibly about political ideologies. The author notes and emphasizes with much satisfaction that in practice the totalitarian systems cannot escape the fundamental laws of economics. Prices are still determined by supply and demand, capital is formed by savings, private initiative is necessary for the development of enterprises. No matter what the ideology the economic laws still triumph, says the author with verbal transports of joy. Since this volume embodies lectures given to students, the author's naive tone may be forgiven but it must not be forgotten that long ago the mathematical economists adequately demonstrated the consequences relative to price, production, and consumption of alterations in the postulates that characterize a liberal economy. The results observed in the totalitarian states, in Japan, and in this country only furnish further proof of the validity of the deductions.

ONCE IN SINAI. *The Record of a Solitary Venture.*

By Joan M. C. Plowden. With a Foreword by Major C. S. Jarvis. Methuen and Co., London. 12s. 6d. net. 8 x 5⅛; xv + 302 + 8 plates + 1 folding map; 1940.

This is a delightful story of travel and exploration. The author denies that she had any adventures but those who read the account of the man-eating shark will disagree with her.

Although one of the world's bleakest deserts, the peninsula of Sinai is full of romance. Tradition makes it the land of Midian. In ancient history it was the scene of the Exodus and it was here that Elijah survived the wind, the fire, and the earthquake, and heard the still small voice. The mediaeval period saw the erection here of the convent of Saint Catherine of Alexandria (not to be confused with St. Catherine of Siena) and in modern years it acquired associations with Tischendorf and the Codex Sinaiaticus.

Being so largely a record of personal experience the book contains little in the way of original contributions to science, but one incident may be mentioned. On a mural in the convent of Saint Catherine, which was built in the reign of Justinian, is the figure of a dodo. Now this bird was not known to science until the sixteenth century. Is it possible that there were dodos on the peninsula of Sinai at an early period that have since become extinct? The description of the quail in the Biblical account that stood

two cubits above the ground implies that there may have been. But the author is not a biologist and does not pursue the matter further.

The book is well illustrated with the author's photographs, and her route can easily be followed by means of numerous maps.

JAPAN'S EMERGENCE AS A MODERN STATE. *Political and Economic Problems of the Meiji Period. I.P.R. Inquiry Series.*

By E. Herbert Norman. Institute of Pacific Relations, New York. $2.00. 9 x 6; xiii + 254; 1940.

The year 1868, the year of the so-called Meiji Restoration, marks the beginning of the transformation of Japan from a feudal agrarian state to a modern industrial nation that can compete with the United States and Great Britain. In that year one group of aristocrats wrested the power from the controlling group and aided by the financial support of the leading banking houses was able to alter the economy of the country according to its will. Thus, as the author well emphasizes, what took place was not a revolution by the people but merely a change of authority from one to another set of persons among the ruling castes. The latter, being composed of able and far-sighted men, recognized the significance of the economic evolution of the leading Western countries and decided to follow suit while at the same time they attempted and at times succeeded in avoiding some of the errors that accompanied the industrial and commercial development in Europe and this country. Furthermore, Japan was fortunate because being small and with limited natural resources it did not excite the cupidity of the Western powers and was saved from the fate of China. These seem to be the principal factors affecting the progress of Japan as described in this account which covers the commercial, agricultural, and industrial, as well as political changes in Japan from 1868 to the Russ-Japanese conflict. Within the limits of the subject discussed this scholarly monograph is interesting not only for its timeliness but also because of the style in which it is written.

WHITE WATER AND BLACK MAGIC.

By Richard C. Gill. Henry Holt and Co., New York. $3.00. 8½ x 5½; xiv + 369; 1940.

This is the story of the Rio Pastaza whose turbulent, rock-torn white waters flow with eager haste through the land of the Ecuadorian Oriente to the Mother Amazon; it is the story of the Ecuador Indians and their "flying death," curare, in the preparation and use of which the black magic of the jungle pharmacologists play a paramount rôle; it is the story of the conversion of curare from the lethal poison of witchmen to the therapeutic drug of "men in white"—a drug beneficial in cases of spastic paralysis, as a shock-absorber in convulsive shock therapy in psychiatric treatment, and possibly in other therapeutic fields. The author, an ethnobotanist, and his wife live on the hacienda, Rio Negro, a plantation ranch molded out of "wild living forest," on the Pastaza in the Ecuadorian hinterland. It was to this ranch that all wanderers on the Pastaza Trail came—solitary Indian hunters and messengers, jungle chieftains with their tribal retinues, "miscellaneous" scientists, old-timers, new-timers, school teachers, petty adventurers, prospectors, missionaries, journalists, colonists-to-be, colonists-who-had-been, etc., and it was from this ranch that the author traveled into the jungle to live in Indian villages, to learn more about the pharmacopoeia of the forest, and to become an accredited medicine man among the Indians. From this "jungle drugstore" the Gill-Merrill Ecuadorian Expedition brought back enough botanical specimens of curare for large scale medical research, as well as other important herbs. The volume includes duplicate maps on the inside front and back covers, numerous photographs, and an index.

THE DISCOVERY OF MAN. *The Story of the Inquiry Into Human Origins.*

By Stanley Casson. Harper and Bros., New York and London. $3.00. 8½ x 5¾; 339 + 16 plates; 1939.

This is an outline of the more important developments and personalities in the history of cultural anthropology and

archaeology. Although with Aristotle, Herodotus, and Tacitus, the ancient world contributed greatly to our knowledge of these aspects of human biology, it is really only from the 17th and 18th centuries that systematic progress began, and the author justly dedicates the major portion of the book to the pioneers of that epoch. The author opens this history with an account of the "pilot books" of the Carthaginian Hanno. He mentions in passing Anaximander and Archelaus, to discuss more leisurely Herodotus, Hippocrates, Aristotle, Pliny the elder, and Tacitus. He is little impressed by the writings of the Romans and singles out Pliny, particularly, with ironic and sarcastic comments. Following the Renaissance and the discovery of America the first systematic observations on cultural anthropology are reported, notably that of John Scheffer (1674); and with the work of Stukeley (1687–1765) some beginning is made in archaeological field investigations. The progress thereafter becomes accelerated, leading to our present knowledge on the subject. In discussing the modern contributions the author is interested primarily in the theorists, especially the English theorists. The book suffers from this change of method and accompanying style. While the first part is interesting and easy to read, the latter sections have the scholarly but pedantic qualities of a synoptic history text.

ÉTAT DE LA POPULATION D'APRÈS LES RECENSEMENTS. MIGRATIONS. *Actualités Scientifiques et Industrielles, 786. Cours de Démographie et de Statistique Sanitaire. III.*

By Michel Huber. Hermann et Cie, Paris. 30 francs. 10 x 6½; 108; 1939 (paper).

NUPTIALITÉ, NATALITÉ, FECONDITÉ. *Actualités Scientifiques et Industrielles, 801. Cours de Démographie et de Statistique Sanitaire, IV.*

By Michel Huber. Hermann et Cie, Paris. 40 francs. 10 x 6½; 131; 1939 (paper).

The first two numbers in this series were published in 1938 under the titles *Introduction à l'étude des statistiques démographiques et sanitaires* (No. 598) and *Méthodes d'élaboration des statistiques démographiques (recensements, état civil, migrations)* (No. 599), respectively.

In Number III the author presents data on the total population of the earth and its distribution by geographical areas; methods of census taking used in various countries, and the enumeration of the various kinds of data on the distributions of populations by age, sex, civil status, language, religion, etc. that can be obtained from census material; and migration.

Number IV illustrates from actual data, the type of information that can be calculated from census material and from birth and death registrations concerning number and rates of marriages, divorces, births (live and still, legitimate and illegitimate), sex ratios at birth, infant mortality, and fertility. A large part of the illustrative material pertains to France in the last quarter of a century.

O. C. MARSH: *Pioneer in Paleontology.*

By Charles Schuchert and Clara M. LeVene. Yale University Press, New Haven; Oxford University Press, London. $5.00. 9¼ x 6¼; xxi + 541 + 30 plates; 1940.

Whatever Othniel Charles Marsh's peculiarities (to use a milder word than some of his contemporaries would have) of character and personality may have been, he was one of the great figures in the history of vertebrate paleontology. A definitive biography has long been needed. The need is admirably filled by the present volume. The authors had unusual, indeed almost unparalleled, facilities for the task, in the way of access to Marsh's papers, collections, and *memorabilia* of all sorts and kinds. They have made excellent use of these resources, and have turned out a book that is readable, as well as accurate and detailed, about a man who was intrinsically somewhat lacking in charm or interest of personality, as those words are usually understood. All the testimony, including that of this book, indicates that Marsh was a pompous, selfish, vain, strutting sort of a Tory, who never in his life had the smallest conception that the pleasures of con-

descension were singularly one-sided, as Stevenson put it. His attitudes and relations towards and with assistants and colleagues present a picture that can scarcely be regarded as either pleasant or normal. None the less he was indubitably a great paleontologist, and this volume is a contribution of first rate importance to the history of science. The book is adequately indexed and illustrated.

RUTHERFORD: *Being the Life and Letters of the Rt. Hon. Lord Rutherford, O.M.*

By A. S. Eve. Foreword by Earl Baldwin of Bewdley. The Macmillan Co., New York; University Press, Cambridge. $5.00. 9¾ x 6½; xvi + 451 + 18 plates; 1939.

In this first authorized biography of one of the greatest of modern scientists the author has not only recorded in sequence the salient facts of his subject's life and scientific contributions, but in addition, has devoted a major portion of the book to the correspondence that passed between Rutherford and his wife, his mother, and his colleagues. As a consequence, the reader is enabled to catch a glimpse of a live and very human Rutherford. It is no more than a glimpse because the author seems to take special care in avoiding comments on the personality of his hero and from the correspondence only a disconnected and fragmentary view is obtained. It would appear that Rutherford was a cocky fellow, well aware of his genius and not too modest about it. Early in life he became interested in the detection of Hertzian waves and began inventing apparatuses for the purpose. From his native New Zealand he went to Cambridge where, under J. J. Thomson, his career took its shape. Through the latter he obtained the post at McGill and there were initiated the investigations that led to the Nobel prize, fame, glory, and an English peerage. Rutherford lived a full and interesting life and the author has succeeded in describing it so well that this will undoubtedly rank among the best of biographical sketches to appear in recent years.

CULTURAL AND NATURAL AREAS OF NATIVE NORTH AMERICA. *University of California Publications in American Archaeology and Ethnology. Volume 38.*

By A. L. Kroeber. University of California Press, Berkeley. $3.50 (cloth); $3.00 (paper). 10⅜ x 6¾; xi + 242 + 9 folding maps + 1 folding table; 1939.

This is a comprehensive, extensively documented work on the cultural and natural areas of native North America from the Arctic Circle to the region of Central America. The tribal, cultural, physiographic, and vegetational areas of North America are discussed and pictorially presented in many textual and loose maps, the latter of which are enclosed in a pocket at the end of the text. Population densities are given by tribes, areas, language groups, etc. Environmental and cultural factors are presented in relation to physiography, natural vegetation, climate, water, and drainage. Invaluable to the student is the author's evaluation of literature and discussion of theories expounded in the broad field of cultural anthropology on the native cultures of North America. Bibliography and notes are not separately appended but appear in the textual matter and footnotes. An index and a detailed table of contents are included. The 17 text tables, 21 text maps, 1 pocket table, and 8 pocket maps should be of inestimable aid to the student in this field.

HUMAN BIOLOGY.

By George A. Baitsell. McGraw-Hill Book Co., New York and London. $3.75. 9 x 6; xv + 621; 1940.

Baitsell's text is a needed contribution to a new field of modern science in which acceptable textbooks are few and far-between. This distinctly new and refreshing book endeavors to present the pertinent facts of biology from the vantage ground of the most interesting and important organism in the world of life—man himself. Accordingly, the study of human biology involves a great deal more than human anatomy and physiology: it is essentially a humanizing of general

biology in that attention is centered primarily on human structure and function rather than on the characteristics of types selected from the lower organisms. In an endeavor to widen the scope of the book, so that the interested student may have abundant material to pursue important fields of interest at advanced levels, an appendix has been supplied containing direct quotations from the publications of various authorities. Original material by the author is also presented. The book is well and appropriately illustrated and a complete index has been included.

PENOBSCOT MAN. *The Life History of a Forest Tribe in Maine.*

By Frank G. Speck. University of Pennsylvania Press, Philadelphia; Oxford University Press, London. $4.00. 9¼ x 6¼; xx + 325; 1940.

Much has been written about the Indians of western North America while comparatively little ethnological work has been done among the tribes of northern New England and eastern Canada. The present work is a fine contribution to this neglected field.

Personal contact with the Penobscot Indians of Maine, beginning in 1909 when they were still an independent forest people instead of curiosities for the tourist, makes Frank G. Speck an authority on this tribe of the Algonkians. He tells of their history, their folk-lore, their daily round of life, their physical and mental characteristics, and their adjustment to the white man's world. As one closes this book one wishes with the author that these interesting inhabitants of the old forests need not have become steel-workers and factory hands.

FIJIAN FRONTIER. *Studies of the Pacific No. 4.*

By Laura Thompson. Introduction by B. Malinowski. American Council, Institute of Pacific Relations, San Francisco, New York and Honolulu. $2.00. 9 x 6; xxiii + 153 + 7 plates; 1940.

This study, which Malinowski in his introduction terms "an artistic picture of primitive life in one of the most fascinating parts of the world," gives an analysis of the history of the Fijians, their customs, their religion, their psychology, and their reactions to the presence of civilizing influences. Thompson believes that when the natives of the Fiji groups have been educated to make the fullest use of their native resources, both manual and natural, and when the present pauperizing influences of soliciting and ceremonial giving are banished, the term "famine isles" with all that it implies will be lifted for once and for all from these picturesque British-owned islands in the tropical Pacific.

DOCTORS IN SHIRT SLEEVES: *Musings on Hobbies, Meals, Patients, Sport and Philosophy.*

Edited by Sir Henry Bashford. Veritas Press, New York. $2.00. 8½ x 5½; xii + 294; 1940.

The twenty-five entertaining essays appearing in this volume were selected from a series of articles on diverse subjects contributed by medical men to the *Lancet* and published therein as a weekly feature under the heading "Grains and Scruples." Hobbies, reflections, reminiscences, personal experiences, and theories—gastronomic, literary, biological, educational, spiritual, etc.—form the subject matter of the essays. Each contributor has been given full freedom in choice of subject and style of writing. The fortunate result, the present volume, is a compilation of the "off-duty musings" of medical men who write in a witty and knowing way on a diversity of subjects.

THE MAN IN THE MOONLIGHT.

By Helen McCloy. William Morrow and Co., New York. $2.00. 7½ x 5¼; [6] + 312; 1940.

In these *Brief Notes* comments on novels are rarely included. But the present volume has a distinctive right to be present. It is a biological detective story that is good; both as story and as human

biology. The master mind, Basil Willing, is a competent and sensible psychiatrist; the action takes place in and about a university in New York City not terribly difficult to identify under its pseudonym; and the professors involved in the story behave more nearly as actual professors do than is the case in most fiction. Furthermore the scientific matters, with which the book teems, are handled throughout with considerable real understanding. Mostly the professional scientific man will not gag as he reads the book, which is saying a lot as the bulk of pseudo-scientific fiction goes. Regrettably we do not have the pleasure of knowing Helen McCloy personally, or anything about her. But on the evidence afforded by this volume she is certainly to be encouraged to go on writing.

CANOE TO MANDALAY.

By Major R. Raven-Hart. Frederick Muller, London. 10s. 6d. net. 8½ x 5½; [4] + 245 + 16 plates; 1939.

Major Raven-Hart's 16,000 miles canoeing experience served him well on his Burmese journey of 600 miles which took him from Myitkyina down the Irrawaddy to Rangoon. With only the help of a 15-year-old lad, and at the risk of contracting malaria or the plague, or of capsizing in the whirlpools of the river, the author made the perilous journey without any major mishap. The places he visited, the people he met, as well as his experiences in learning the Burmese language and customs, are set down in a most fascinating and readable fashion. The author's spicy humor is only one of the many factors which make for thoroughly enjoyable reading. The text is generously supplied with photographs of the people and places visited. The concluding pages of the book contain an appendix of practical details, a table of distances, and an index.

A MAN WHO FOUND A COUNTRY.

By A. Nakashian. Thomas Y. Crowell Co., New York. $2.75. 8½ x 5¾; viii + 279; 1940.

The author's experiences in a country so entirely different from our own makes most fascinating reading. An Armenian, living under Turkish rule, Dr. Nakashian was a subject from the outset of prejudice and persecution. Through determination and a blind trust in luck he managed to obtain a medical degree at the American University then newly established at Beyrouth. His subsequent practice led him among beggars, thieves, rich lords, and high officials, while at the same time he and his family were in almost constant flight for their lives. During the World War the author was imprisoned for months but was released and made a captain in the Turkish army because of the dire need for surgeons. When racial and religious persecutions continued after the war, the family moved to this country. The book not only pays tribute to the American doctors and missionaries who worked in the Near East, but it is also an interesting and well-written historical account of the fall of the Ottoman Empire.

SCOTT OF THE ANTARCTIC. *A Study in Character.*

By George Seaver. John Murray, London. 10s. 6d. net. 8½ x 5½; vii + 187 + 14 plates; 1940.

When Captain Scott set out on his expedition to the South Pole, he had two purposes in mind: (1) British priority at the Pole; and (2) the satisfying of his own quest for exploration and adventure. Although he failed in the former by a mere month, the latter purpose was completely fulfilled, as attested by his diary in which he wrote his experiences right up to the minute of his death. Faced with unsurmountable difficulties, and always working against great odds, Scott was a man who never gave up. His heritage and early training, his physical, moral, and intellectual characteristics, his failures and successes, all of which contributed to his indomitable spirit, are interestingly recorded in this little volume by Mr. Seaver. The story of Scott's life will be read and enjoyed, not only by Britishers, but by all throughout the English speaking world who are interested

in exploration, adventure, and human character.

GOVERNMENTS AND BIRTH CONTROL. *Population Increase Versus The Kingdom of God on Earth.*

By F. E. Austin. The Austin Workshops, Hanover, N. H. $1.00. 6 x 4¾; 130; 1940.

According to the author's statement thirty-two pages of this book are alone worth at least sixteen dollars. But in the prologue he still expresses some fear lest reviewers should find that it has no meritorious features. Let it be said that Mr. Austin points out some of the fundamental biological truths regarding war and overpopulation. Numerous figures, some of them valid, others rather comical, are presented to show that the world is fast going to the dogs. Two alternatives remain—wholesale annihilation of populations, or radical limitation of births. Among the pages is considerable discussion about the establishment of a Heavenly Kingdom on earth by the United States and Great Britain, with the "isms" doomed to failure because they are not in accord with Divine command, all this being supported by numerous biblical quotations. Let us all take precautions against Armageddon!

THE ATLANTIC MIGRATION 1607–1860. *A History of the Continuing Settlement of the United States.*

By Marcus L. Hansen. Edited with a Foreword by Arthur M. Schlesinger. Harvard University Press, Cambridge. $3.50. 8⅝ x 6; xvii + 391 + 9 plates; 1940.

The continuing migration of the peoples of the Old World to the Western Hemisphere, and particularly to North America, has been one of the most important and significant migratory movements from every point of view, of which there is record in history or evidence in prehistory. The late Professor Hansen has provided in this volume a thorough, scholarly, comprehensive, and readable account of this movement and its consequences and implications. The book is thoroughly documented and indexed, the *Bibliography and Notes* occupying over 60 pages. The approach and treatment in this volume is analytic throughout. Synthesis would doubtless have followed if Prof. Hansen had lived longer. But as a clear, logical, and sound untangling of an intricate web of social forces of extreme complexity this book will have permanent value to historians, sociologists, and human biologists generally.

ARGENTINE TO ANDES.

By Hanna Rydh. Translated from the Swedish by Mary Sandbach. Blackie and Son, London and Glasgow. 10s. 6d. net. 8½ x 5½; xi + 171 + 47 plates; 1940.

This is an exciting and refreshing account of a rather unique journey told in a most readable and friendly manner. Dr. Rydh, a Swedish archaeologist, went to South America on a lecture tour, and while there, took the opportunity of visiting the chief centers of those civilizations which existed before the arrival of the Spanish and Portuguese. Traveling from Buenos Aires to La Paz, the author stopped to study the remains in the northern provinces of Argentina on the eastern slopes of the Andes, and near the borders of Bolivia. She was greatly interested in the Inca ruins around Lake Titicaca and in Cuzco, the very center of the Inca empire. During her stay in Cuzco, the feast of Corpus Christi was celebrated and her description of the ceremony is most graphic. The book concludes with a charming description of the city of Lima. The volume is exceptionally well illustrated and an index has been provided.

RACE, LANGUAGE AND CULTURE.

By Franz Boas. The Macmillan Co., New York. $5.00. 9¼ x 6⅛; xx + 647; 1940.

This volume, a compilation of sixty-three papers by Franz Boas, represents the basic anthropological views of one of the most dominant figures in the field of anthropology. The articles were chosen by

Boas from his numerous publications of the past fifty-odd years, the earliest printed in this volume being *The Study of Geography* (published 1887) and the most recent, *Growth* (1892–1939, revised and condensed).

Hitherto many of the works of Franz Boas were more or less inaccessible to students, due to the fact that his writings have appeared in numerous journals. Boas's researches extend into all branches of anthropology and this work is a collection of his more important contributions to the fields of physical and cultural anthropology. There are numerous graphs, drawings, and photographs. A detailed table of contents takes the place of an index.

AN INTRODUCTION TO CULTURAL ANTHROPOLOGY. *A New and Enlarged Edition.*

By Robert H. Lowie. Farrar and Rinehart, New York. $3.50. $8\frac{3}{8}$ x $5\frac{5}{8}$; xx + 584 + 16 plates; 1940.

Part I of this edition has remained essentially unchanged from the 1934 publication reviewed in this journal (cf. Vol. 10, p. 347). Entirely new chapters discuss language and the theory of culture. The author upholds the view that cultural variations between peoples are separate and distinct from racial differences. The second part of the volume, almost entirely new and supplementary to the first edition, treats typical cultures, including our Western civilization as well as several primitive tribes. A number of maps and drawings accompany the text and the volume is made complete by an index and enlarged bibliography of 16 pages.

ADVENTURES OF A BIOLOGIST.

By J. B. S. Haldane. Harper and Bros., New York and London. $2.75. $8\frac{1}{2}$ x $5\frac{3}{4}$; vii + 281; 1940.

This volume consists of a series of essays—already published through some medium or other—which are, as Haldane says, "by-products of my other activities, namely scientific teaching and research, and, since 1936, political work." In essence they describe intellectual explorations into human biology and are written in a smooth smart style that will probably appeal more to the so-called intelligentsia than to the general public. A multitude of topics is covered, all to some degree cosmic: climate, origin of life, the geophysical universe, etc. About one half of the essays deal with problems of sociology: of course included is also a note on Marxism. The reader, even though not particularly interested in Professor Haldane's feelings and thoughts about such matters, will undoubtedly enjoy the book.

EMIGRANT COMMUNITIES IN SOUTH CHINA. *A Study of Overseas Migration and Its Influence on Standards of Living and Social Change.*

By Ta Chen. English Version Edited by Bruno Lasker. Institute of Pacific Relations, New York. $2.50. 9 x 6; xvi + 287; 1940.

The field study on the emigrant communities of East Kwangtung and South Fukien in South China was undertaken as an inquiry into the "nature and consequences of cultural change in the Pacific" and "into the part played by Chinese emigration to the near-by countries of the South in changing the standards of living in the home communities. . . ." This research on the causes and cultural effects of emigration should be of great interest to the student of migration, culture diffusion, and sociology. There are numerous tables, three appendices, and an index.

INGALIK MATERIAL CULTURE. *Yale University Publications in Anthropology. Number 22.*

By Cornelius Osgood. Yale University Press, New Haven; Oxford University Press, London. $4.00. $9\frac{3}{4}$ x 7; 500 + 11 plates; 1940 (paper).

The data on which this volume has been based were recorded in the Alaskan village of Anvik during the summers of 1934 and 1937, under the auspices and

with the financial support of Yale University. The present work is the first of an intended series of papers. It deals primarily with descriptive data from the analytical point of view. Later it is hoped to present a consideration of certain ethnological theories to which these data from the north are pertinent. The book is illustrated with numerous line drawings, maps, and photographs. The appendices furnish additional Ingalik information of diverse character. There is a bibliography and an index.

ADVENTURES IN GOOD EATING. *Good Eating Places Along the Highways of America. Seventh Edition.*

By Duncan Hines. Adventures in Good Eating, Bowling Green, Ky. $1.50. 7½ x 5; 296; 1940 (paper).

The automobile traveler unconsciously has had no small part in the production of this guide that now appears in its seventh edition (tenth printing—the first edition appeared in 1936). It seems to be thoroughly dependable. Naturally it is not possible for one person to check up on all the places listed but apparently there are many competent and willing helpers. Occasionally there are omissions and doubtful inclusions. Some of these errors, however, will undoubtedly be ironed out with the continuation of the present standard of checking. Besides the United States the survey includes Canada, Alaska, Mexico, and Hawaii.

LABORATORY OF ANTHROPOLOGY. *Technical Series, Bulletin No. 10. Archaeological Survey.* Containing the following articles: *A Variation of Southwestern Pueblo Culture*, by J. D. Jennings; *Analysis of the Skeletal Material*, by Georg Neumann.

Laboratory of Anthropology, Santa Fe, N. M. $1.25. 10¾ x 8⅜; 20 + 8 plates; 1940 (paper).

The slow and arduous task of excavation in the attempt to learn more about the life and activities of pre-historic man of North America has taken many scientific groups into the rich fields of Indian culture of the southwestern United States. The present bulletin describes the industrial and skeletal finds of three excavations in the Peñasco River Valley of New Mexico. Everything found was indicative of a southwestern Pueblo culture dating somewhere around 1150–1300.

A short bibliography, and several maps and photographs conclude the paper.

CONTRIBUTIONS TO THE RACIAL ANTHROPOLOGY OF THE NEAR EAST. *Papers of the Peabody Museum of American Archaeology and Ethnology, Harvard University. Vol. XVI, No. 2.*

By Carl C. Seltzer. Based on Data Collected by Henry M. Huxley. With a Foreword by Henry M. Huxley. Peabody Museum of Archaeology and Ethnology, Cambridge. $1.00. 9¾ x 6½; x + 62 + 8 plates; 1940 (paper).

ZOÖLOGY

THE LOUSE: *An Account of the Lice Which Infest Man, Their Medical Importance and Control.*

By Patrick A. Buxton. Williams & Wilkins Co., Baltimore. $3.00. 8½ x 5½; ix + 115; 1940.

It is apparent that our generation is the first in the history of mankind to think the human louse sufficiently important to warrant any particular activity from man other than that of scratching. In this important treatise Buxton has recorded much of the recently gathered knowledge of the human louse, with special reference to its life and activities, its importance as a vector for infectious diseases, its control, as well as the methods used in rearing it in the laboratory for experimental purposes. From the medical point of view, the treatment of the subject is complete. Much space is devoted to the relations of the louse to the Rickettsias and Spirochaetes responsible for typhus and relapsing fever respectively. The belief that each of these diseases is spread by rubbing either the feces or the fluids from the broken bodies of the lice into

abrasians of the skin, rather than by the bite and blood sucking process of the louse, is thoroughly documented, and appears to be universally accepted. From a biological point of view, there are many gaps in our knowledge concerning the human louse. The author states,

> "There is no evidence that it [the louse] can establish itself and breed on other hosts. The only possible exception is of certain monkeys, from which lice hardly distinguishable from *P. humanus* have been recovered in zoological gardens; the simple experiment of infecting clean monkeys with human lice and observing the result has not yet been performed." "Several records appear to suggest that the blood of some animals (especially of rodents) is poisonous to *Pediculus;* no one has performed the simple experiment of comparing the length of life after sucking guinea-pig or rat with that of controls on man, or even of unfed controls." "With regard to digestion [in the louse] nothing is known."

In the admission of these gaps in our knowledge, Buxton suggests possibilities for research, though we wonder why these simple experiments were not performed by the author himself long ago—particularly the ones concerning the rearing of human lice on other hosts. If the human louse could be found to live, or could be induced to live and reproduce normally on a monkey, the present annoying method of rearing them on human subjects for laboratory work would be eliminated.

The text is well illustrated, completely indexed, and boasts a bibliography of 108 titles.

THE RATTLESNAKES, GENERA SISTRURUS AND CROTALUS. *A Study in Zoogeography and Evolution. Special Publication Number Four.*

By Howard K. Gloyd. The Chicago Academy of Sciences, Chicago. $2.50. 9¾ x 7; vii + 266 + [4] + 31 plates; 1940 (paper).

The origin, evolution, and dispersion of the rattlesnake make up the content of this authoritative and scholarly dissertation. The fact that snakes make poor fossils has been responsible for the meager paleontological material concerning the origin of the rattlesnake. However, it is almost a certainty that the rattler had his origin in southwestern North America, and more particularly, the north central portion of the Mexican plateau. In general, the further the rattlesnake has migrated from this region, the greater have been the variations and specializations in its evolutionary process. According to the best evidence Gloyd has been able to gather, there was a widespread distribution of the genus *Crotalus* in the United States during Pleiocene times.

Some 45 species of rattlesnakes are described in detail, particular note being made of the variations in size and color, the distribution, range, and the affinities for other species. A key to the species and sub-species of rattlesnakes, a bibliography of 303 titles, a complete index, as well as numerous tables, graphs, and photographic plates of many of the species listed, indicate the completeness of the work.

FORAMINIFERA: *Their Classification and Economic Use. Third Edition, Revised and Enlarged, with an Illustrated Key to the Genera.*

By Joseph A. Cushman. Harvard University Press, Cambridge; Oxford University Press, London. $6.00. 9 x 6; ix + 426 + 48 plates; 1940.

Biologists and palaeontologists are becoming increasingly aware of the importance of this great group of single-celled animals, of which nearly 500 genera are now recognized. In the oceans they occur in untold numbers, their tests (secreted material which hardens into shapes characteristic for each form) largely making up the thick ooze of the ocean floor. As fossils, in the Paleozoic and even younger formations, they formed thick limestone—the pyramids of Egypt are largely of such limestone. Since the species have definite geologic and geographic ranges, they are important in determining the age of sediments and the conditions under which they were deposited. Commercially, their importance is indicated by the fact that many petroleum companies now have in their laboratories workers who have a special knowl-

edge of fossil Foraminifera. In spite of the fact that several thousand papers have been written about the Foraminifera, practically nothing is yet known about the habits and physiologic character of the animal:—a new field for biological investigation is unfolding.

In the present edition of this fine authoritative work the plates and key to the families and genera, which were published as a second volume in the second edition, have been added to the text under a single cover. The bibliography (58 pages) is extremely useful. An important reference book for all biological laboratories.

A Statistical Study of the Rattlesnakes. *VII. The Rattle, Part 1. Occasional Papers of the San Diego Society of Natural History. Number 6, May 18, 1940.* *By Laurence M. Klauber. San Diego Society of Natural History, San Diego, Calif.* 8⅜ x 5⅜; 62; 1940 (paper).

This contribution maintains the high standard set by the author in his previous work on various aspects of the physiology and somatology of the rattlesnake. There are first discussed the many erroneous ideas concerning the use of the rattle: namely, as a mating call, as a call for help from other rattlers, to warn other rattlers from danger, to paralyze, decoy, charm, lure, and warn prey or other intruders, to prevent an attack on the tail, as a substitute for hissing, as a religious warning, and as a venom carrier. The author dismisses, with excellent reasons based on field observations, all the above suggested uses for the rattle except that of a warning to intruders. This he believes to be its sole function, and that it is put to this use only after procrypsis has been unsuccessful in preventing discovery. The discussion contains detailed analyses of the number and measurements of rattles from various species, together with the method of vibration, the process of growth and shedding, as well as a chemical analysis of the horny material which constitutes the rattle.

Features which add to the usefulness of the paper are the table of contents and the list of 145 bibliographic references.

A Field Guide to the Birds: *Giving Field Marks of all Species Found East of the Rockies. Revised and Enlarged.* *By Roger T. Peterson. Houghton Mifflin Co., Boston.* $2.75. 7¼ x 4½; xx + 180 + 40 plates; 1939.

The need for a field guide based on the field markings of birds was the prompting circumstance for the writing of this book. The author expects it to be used to supplement the standard ornithological works in identifying live birds on the wing, or on trees, or thickets at a distance, by impressions, patterns, and distinctive markings, rather than by the minute anatomical measurements and markings used by collectors.

In this edition, completely revised and enlarged, some 78 families of birds are described, including many genera and species native to that section of the North American continent east of the Rocky Mountains. The text is generously supplied with illustrations in color, and black and white. A list of home reference suggestions and an extensive index complete the volume.

Zoologica. *Scientific Contributions of the New York Zoological Society. Vol. XXV, Part 1, Numbers 1–10.* *New York Zoological Society, Zoological Park, New York.* $1.75. 10½ x 7; 116 + 15 plates; 1939 (paper).

The following papers appear in this number: The breeding behavior of the common shiner, *Notropis cornutus* (Mitchill), by E. C. Raney; Divergence and probability in taxonomy, by Isaac Ginsburg; Miscellaneous notes on the eggs and young of reptiles, by Roger Conant and Alexander Downs, Jr.; Occlusion of the venom duct of Crotalidae by electrocoagulation: an innovation in operative technique, by D. B. Jaros; Eastern Pacific expeditions of the New York Zoological Society. XVII. A review of the American fishes of the family Cirrhitidae, by

John Tee-Van; Eastern Pacific expeditions of the New York Zoological Society. XVIII. On the post-embryonic development of Brachyuran crabs of the genus *Ocypode*, by Jocelyn Crane; New species of British Guiana Heterocera, by W. Schaus; A papillary cystic disease affecting the barbels of *Ameiurus nebulosus* (Le Sueur), caused by the Myxosporidian *Henneguya ameiurensis* sp. nov., by R. F. Nigrelli and G. M. Smith; Caudal skeleton of Bermuda shallow water fishes. IV. Order Cyprinodontes: Cyprinodontidae, Poecilidae, by Gloria Hollister; The histology of the eye of the cave Characin, *Anoptichthys*, by E. B. Gresser and C. M. Breder, Jr.

NATURAL HISTORY OF THE BIRDS OF EASTERN AND CENTRAL NORTH AMERICA.

By Edward H. Forbush and John B. May. Illustrated by Louis Agassiz Fuertes, Allan Brooks and Roger T. Peterson. Houghton Mifflin Co., Boston. $4.95. 11¼ x 7½; xxv + 554 + 97 plates; 1940.

This volume is a revision and abridgement of Forbush's very fine work *Birds of Massachusetts and other New England States*. The junior author's task, by no means an easy one in following Forbush, has been extremely well done. The work, originally in three volumes, has been abridged into one, and at the same time the field extended to include all the birds east of the Dakotas, Nebraska, and Kansas, as far south as Florida, and north through eastern Canada. Something over 100 species have been added. The life history and detailed descriptions of all species and sub-species which are commonly found in this area, whether breeding birds, winter visitors, or migrants, are given; and in order to make the list quite complete the "stragglers" or "accidentals" of the region are given in an appendix—but without descriptions.

Indexes are included for both scientific and common names and at the end of the volume are the fine colored illustrations by Fuertes, Allan Brooks, and Roger Peterson—97 plates altogether. The price of the book seems to us most moderate.

WONDER CREATURES OF THE SEA.

By A. Hyatt Verrill. D. Appleton-Century Company, New York and London. $3.00. 8¼ x 5½; xvi + 272 + 10 plates; 1940.

Rapidly swelling book lists are science books written for popular consumption with much of the superabundant esoteric terminology of the scientific world deleted. *Wonder Creatures of the Sea*, a successful addition to the above-mentioned lists, describes the habits and dwelling places of invertebrates found on sea shores, in streams, tidepools, bays, and in the ocean's depths. There are splendid color and action descriptions of such denizens of the seas as sand-dollars, sea-urchins, king-crabs, starfishes, lobsters, sea-cucumbers, sponges, spider-crabs, corals, sea-squirts, and innumerable others. The scientific status (families, genera, etc.) of the wonder creatures is omitted whenever possible as is also a minutely detailed description of their anatomy. There are many excellent line drawings by the author. Photographs and index are included.

THE COD FISHERIES. *The History of an International Economy.*

By Harold A. Innis. Yale University Press, New Haven; The Ryerson Press, Toronto; Oxford University Press, London. $3.50. 9¾ x 6½; xviii + 520; 1940.

Cod fishing was very important to the economics of the early inhabitants of the American sea coast. This harvest obtained from the sea for a long time rivalled the produce of the opening wilderness. Even today, although its importance has been relatively lessened by the rise of industry, it remains a world of its own in international economy, one in which the interplay of American, Canadian, and European interests has created a situation unique in history. The narrative begins with a chapter on European history. This is followed by a description of more recent times, when cod fisheries passed almost completely into the hands of the seamen of New England and Nova Scotia. The work contains many footnotes and is well indexed.

STUDIES IN THE MECOPTERA. Containing: *Biology and Morphology of Some North American Bittacidae (Order Mecoptera)*, by L. R. Setty; *The Genital Anatomy and Mating Behavior of Boreus brumalis Fitch (Mecoptera)*, by Kenneth W. Cooper.

The American Midland Naturalist, University of Notre Dame, Notre Dame, Indiana. $1.00. 9 x 5¾; 111; 1940 (paper).

The detailed report (including 178 line drawings, 68 references) on the biology and morphology of some of the hanging-flies of North America adds appreciably to the hitherto meager knowledge of these insects that are beneficial to man. Adult bittacids (the adaptation of their hind legs for food-getting is unique) feed on flying mosquitoes: the larvae are scavengers. In addition, the bittacids, in all stages, are excellent material for biology teaching.

Much new material is included in the second of these papers (9 figures, 30 references). In spite of marked internal differences, the mating behavior of *Boreus brumalis* is identical with that of *B. hymalis*. Correspondingly, the external genitalia are remarkably similar.

BRAIN AND BODY OF FISH. *A Study of Brain Pattern in Relation to Hunting and Feeding in Fish.*

By H. Muir Evans. The Blakiston Co., Philadelphia. $3.50. 9½ x 6; 164; 1940.

The author has chosen *Brain and Body of Fish* for his title

> because this condenses in a phrase the remarkable fact that the external conformation of the brain of a bony fish indicates its habits and mode of feeding. In other words, the study of the external condition of the brain in bony fish is an index of the development of those organs belonging to the various sensory faculties.

The brain patterns, bodily structure, and habits of such teleosts as the Cyprinidae (carps), Clupeidae (herrings), flat-fishes (halibuts, soles, flounders, plaices, turbots), Gadidae (cods), and the Anguillidae (eels) are described and the relation between form and function discussed. Numerous drawings by the author illustrate the text material. There is a brief table of contents, but unfortunately no index to either the text or the drawings.

THE BRANCHIOBDELLIDAE (OLIGOCHAETA) OF NORTH AMERICAN CRAYFISHES. *Contribution from the Zoological Laboratory of the University of Illinois No. 537.*

By Clarence J. Goodnight. University of Illinois Press, Urbana. $1.00. 10½ x 7; 75; 1940 (paper).

This is a monograph of annelid worms symbiotic with crayfish, of which nine genera and twenty-one species are known to inhabit the rivers of North America. Of these, three species and one genus are new and another genus has not hitherto been reported from this continent. There are also a few new terms of subgeneric and subspecific rank introduced. The geographic ranges of these animals are quite extensive, and seem to be independent of the size of the stream in which they occur. Also there is no host specificity, so that any worm may cohabit with any crayfish. There are sixty-four items in the bibliography, the oldest of which dates from 1805.

CHECK-LIST OF BIRDS OF THE WORLD. *Volume IV.*

By James Lee Peters. Harvard University Press, Cambridge; Oxford University Press, London. $4.00. 9 x 6; xii + 291; 1940.

Volume 4 of this invaluable check list (for Volume 1, cf. Q.R.B., Vol. 7, No. 3: for Volume 3, cf. Q.R.B., Vol. 12, No. 4) deals with the cuckoos (including the African family of plantain-eaters), owls, goatsuckers, and swifts. The treatment of the forms has been brought up to 31 December, 1938, although a few forms described in 1939 are included. Mostly, these orders have not been completely described since the turn of the last century.

It is interesting at this stage in the development of the *Check-List* to compare the number of genera and species of Sharp's Volume I, issued in 1899, with the forms recognized in the first four volumes of Peters (1931–1940) covering the same orders: Sharp lists 830 genera, 3626 species; Peters lists 569 genera, 5106 forms.

ANTILLEAN TERRAPINS. *Memoirs of the Museum of Comparative Zoölogy at Harvard College, Vol. LIV, No. 5.*

By T. Barbour and A. F. Carr, Jr. Museum of Comparative Zoölogy, Cambridge, Mass. $6.00. 12 x 10; 35 + 9 plates; 1940 (paper).

The West Indian terrapins of the genus *Pseudemys* comprise a section of the wide-ranging *scripta* group, being most closely allied to the Central American *P. scripta ornata*. The *scripta* group is distributed, through a series of integrading forms, from North Carolina into South America. Nine forms are listed and described in this monograph—in the *terrapen* sub-groups, five forms of which two are new subspecies; in the *stejnegeri* sub-group, four forms of which one is a new species and one a new subspecies. A bibliography of 58 titles accompanies the text—also a group of very fine colored plates (31 figures).

AMOUR DE LA CHASSE.

By Jean-É. Benech. Éditions Stock, Paris. 18 francs. 7½ x 4½; 173; 1939 (paper).

This little book traces the life of the hunter and his joys and sorrows from the time he listens of an evening, as a little tot, to the stories of his elders; learning the habits of animals and to recognize their tracks; the time when he is first allowed to handle a gun; his first hunt and his later experiences up to the time when he is an old man and has to content himself by reciting his "adventures" to a younger generation. Delightfully written, the book also contains much material on the habits and food of animals and birds, and the aspects of the country-side during the four seasons.

ANIMAL BIOLOGY. *Second Edition.*

By Robert H. Wolcott. McGraw-Hill Book Co., New York and London. $3.50. 9 x 6; xxi + 649; 1940.

This edition differs little in aim and presentation from that of the first edition (Q.R.B., Vol. 9, No. 1). It is an elementary textbook in zoology. The volume is not intended as a reference and for this reason technicalities are minimized. All morphology is eliminated as the author holds this portion of zoology is best handled by laboratory work. The book possesses many new illustrations, a glossary, and an index.

HERPETOLOGICAL RESULTS OF THE VERNAY ANGOLA EXPEDITION. *With Notes on African Reptiles in Other Collections. Part I. Snakes, Including an Arrangement of African Colubridae. Bulletin of The American Museum of Natural History. Volume LXXVII.*

By C. M. Bogert. American Museum of Natural History, New York. 90 cents. 9 x 6; 107 + 1 plate; 1940 (paper).

Added to the main collections of the Vernay Angola expedition of 1925 are specimens from 16 other collections from various African sources. The specimens, totalling 549, are distributed among 6 families, 52 genera, and 116 species and subspecies. Six are described as new or hitherto unrecognized forms. Many line drawings and photographic plates form part of the report.

A RACE OF THE WARBLING VIREO FROM GUERRERO, MEXICO. *Transactions of the San Diego Society of Natural History, Volume 9, No. 16.*

By A. J. van Rossem. Society of Natural History, San Diego, Calif. 10¼ x 7; 2; 1940 (paper).

NOTES ON SOME NORTH AMERICAN BIRDS OF THE GENERA MYIODYNASTES, PITANGUS, AND MYIOCHANES. *Transactions of the San Diego Society of Natural History, Volume 9, No. 17.*

By A. J. van Rossem. Society of Natural History, San Diego, Calif. 10¼ x 7; 8; 1940 (paper).

THE WORM SNAKES OF THE GENUS LEPTOTYPHLOPS IN THE UNITED STATES AND NORTHERN MEXICO. *Transactions of the San Diego Society of Natural History, Volume 9, No. 18.*

By Laurence M. Klauber. Society of Natural History, San Diego, Calif. 10¼ x 7; 76; 1940 (paper).

THE LYRE SNAKES (GENUS TRIMORPHODON) OF THE UNITED STATES. *Transactions of the San Diego Society of Natural History, Volume 9, No. 19.*

By Laurence M. Klauber. Society of Natural History, San Diego, Calif. 10¼ x 7; 32; 1940 (paper).

TWO NEW SUBSPECIES OF PHYLLORHYNCHUS, THE LEAF-NOSED SNAKE, WITH NOTES ON THE GENUS. *Transactions of the San Diego Society of Natural History, Volume 9, No. 20.*

By Laurence M. Klauber. Society of Natural History, San Diego, Calif. 10¼ x 7; 20; 1940 (paper).

BOTANY

THE BADIANUS MANUSCRIPT. (*Codex Barberini, Latin 241*) *Vatican Library. An Aztec Herbal of 1552.*

Introduction, Translation and Annotations by Emily Walcott Emmart. With a Foreword by Henry E. Sigerist. The Johns Hopkins Press, Baltimore; Oxford University Press, London. $7.50. 12 x 9⅜; xxiv + 341; 1940.

This facsimile of the first medical book of the Western Hemisphere, preceded by a foreword by Henry Sigerist, a lengthy preface on the construction of the manuscript, early knowledge of materia medica, Aztec folklore of medicine, etc., which prepare the reader for the fare that is to come, is indeed a remarkable book. And as one continues on to the end one becomes more and more grateful not only to Dr. Emmart, whose untiring and persistent efforts have made this such a memorable volume, but to all those individuals and groups whose aid, financially and otherwise, have made it possible for such an important and expensive work to be acquired at such a low price. It is a treasure that should be on biological book-shelves and in private libraries, as well as available in public libraries for exhibition purposes.

The original, a little book, 6 inches wide, 8⅛ inches high, and ¾ of an inch thick, bound in crimson velvet, has lain for perhaps three centuries at least in the Vatican Library, its very existence unknown until comparatively recently. On the first fly-leaf is in Latin the following inscription [we give Emmart's translation]: "A little book of Indian medicinal herbs composed by a certain Indian physician of the College of Santa Cruz, who has no theoretical learning, but is well taught by experience alone. In the year of our Lord Saviour 1552."

In the early period following the Mexican conquest the Spaniards established schools and colleges in order to acquaint the Aztecs (one of the most intelligent of the American Indian races) with European culture; and shortly the students were able to speak fluently in both Spanish and Latin. To instruct them in the art of medicine a native physician, Martinus de la Cruz, was brought to the College of Santa Cruz in Talaltelolco—the first college of higher education to be established in the New World. It was Martinus who wrote the text of this little treatise on Mexican medicinal plants and native remedies. Another native, one of the early students, and later "Reader in Latin" at the college, Juannes Badianus, translated the text into Latin.

A table of contents groups the material into 13 chapters, each dealing with a different group of afflictions which tend to range from the head to the feet. In the treatment and cure of these ailments practically all members of the plant kingdom found in Mexico were used—from small rock plants to large trees; from aquatic to desert forms. Among the most interesting of the native Aztec remedies are the narcotics and analgesics. The 87 pages of plant illustrations have been most skillfully reproduced in the present volume and show the brilliant colors of the original manuscript. It is uncertain whether Martinus or Badianus made the original paintings, but they were beautifully and carefully executed. While they perhaps are inferior in technical detail when compared with the 15th and 16th century herbals of Europe, they compare very favorably with those of the 13th and 14th centuries. As in the European herbals the illustrations are of a constant size regardless of the natural size of the plant.

Following the facsimile are Emmart's transcriptions and translations of the

text with many interesting comments and footnotes and the volume is completed by a group of indices referring to Aztec terms, botanical and animal forms, stones, earths and minerals, materia medica, maladies, and a bibliography of over 60 titles.

THE COMPLETE GUIDE TO SOILLESS GARDENING.

By W. F. Gericke. Prentice-Hall, New York. $2.75. 9 x 6; xvi + 285; 1940.

GARDENING WITHOUT SOIL.

By A. H. Phillips. Chemical Publishing Co., New York. $2.00. 8½ x 5½; 137; 1940.

The last word in hydroponics will undoubtedly not be written until sometime in the far future, but, to date, Gericke's scholarly and authoritatively written volume presents all the worthwhile theories, techniques, hopes, and trends of this relatively new phase of botany. In spite of the fact that the soilless method of rearing plants was known and used in plant physiology laboratories since the middle of the last century, Gericke is recognized as the father of hydroponics, because it was he who first grasped the practical significance of the field and prepared the way for its growing success in competition with regular agriculture.

In addition to the discussions on the methods and materials of hydroponics, Gericke suggests the way for profitable investigation in the future, and makes a strong plea for soilless gardening as one of the answers to the present world economic dilemma. The text is generously supplied with illustrations, and the work is concluded with a useful glossary and a complete index.

The second of these volumes, intended for the British public, includes nothing new or original in the field of soilless gardening. The subject is presented in a brief and exact fashion, by one who has a well-grounded knowledge of the physiology of plant growth, and should prove quite helpful to those who have a few minutes each evening to spend on this interesting and worthwhile phase of botany.

THE EVOLUTION OF THE LAND PLANTS [EMBRYOPHYTA].

By Douglas H. Campbell. Stanford University Press, Stanford University, Calif.; Oxford University Press, London. $6.50. 9 x 6; ix + 731; 1940.

For the trained botanist this book makes most interesting reading.

"Plants are, on the whole, far more conservative than animals, and most of the existing types can be traced back to a very remote period." Close relationships between any two groups can only be found among the simpler forms. ". . . some of the most successful living plant types retain certain primitive characters." It is the present practice to class all forms below the mosses (bryophytes) in a single subkingdom, yet "the inclusion in a single subkingdom, of such a heterogeneous assemblage of evidently divergent types is decidedly unscientific. . ." On the other hand, the three groups of higher plants (mosses, ferns, and seed plants) are treated as independent subkingdoms ". . . although it is generally recognized that these three groups are essentially similar in their reproduction. There is abundant reason for placing these three groups in a single subkingdom, Embryophyta, as is done by Engler."

The essential similarity in the reproduction of embryophytes was demonstrated nearly 80 years ago by Hofmeister, but the old classification has still been retained.

This book is concerned with tracing the relationships among the different members of the embryophytes (the typical green land plants) as well as their relationships with their nearest relatives among the algae. Campbell draws upon an abundance of literature as well as his own researches in reaching his conclusions. The detailed treatment of the subject matter, the documentation of the chapters, the 350 figures almost all of which give several views, and the detailed index give testimony to the care with which the volume has been prepared.

THE SCIENCE AND PRACTICE OF CONSERVATION: *Grass and Forage Crops. In Two Volumes.*

By S. J. Watson. Fertiliser and Feeding Stuffs Journal, London. 30s. net. 9¾ x 5⅞; xi + vii + 820; 1939 (paper).

The main object of these volumes is to give a detailed and conservative account of the studies on the conservation of

fodder crops at Jealott's Hill (Jealott's Hill Research Station, Bracknell, Berks, England). In addition, all relevant and important findings, which an examination of the extensive literature from all parts of the world has yielded, have been incorporated. Each of the 23 sections is as complete as it has been possible to make it.

In order to give a general idea of the manner in which the subject matter is arranged we have selected Chapter 13, which is on the losses involved in making silage, and have given the topics around which the discussion takes place: Nature of the losses in silage-making; Measurement of losses; The losses in grass silage; The losses in silage made from legumes, alone or with an admixture of grass; The losses in the ensilage of silage mixtures; The losses in the ensilage of maize and other carbohydrate-rich crops; Comparison of losses in the different groups; Losses of mineral constituents; Loss of vitamins; Conclusions.

The different sections contain much tabular matter and lengthy reference lists and at the end of Volume II are author and subject indexes. An important work.

DESERT WILD FLOWERS.

By Edmund C. Jaeger. Stanford University Press, Stanford University; Oxford University Press, London. $3.50. 8¼ x 5½; xii + 322; 1940.

The name of Edmund C. Jaeger on the title page of any volume is adequate certification of its excellence, and this one is worthy of its predecessors. It is to be hoped, however, that it will not be too successful in popularizing the desert, as the vandalous raids made upon this region by Philistines of a nearby metropolis have got past the stage where they are merely a scandal.

There is probably a greater number of species of flowering plants in the Colorado desert than in any other equal area in the United States, and the need for a reliable textbook containing descriptions and illustrations is evident. This is not so much a field-book as a laboratory manual and if specimens are brought into the laboratory their identification will be greatly facilitated.

The work is amply illustrated by drawings and photographs. The latter are especially worthy of mention. A somewhat unusual but interesting feature is the wealth of biographical material about persons otherwise forgotten, but whose names are perpetuated in those of the plants. These names as well as the names of the plants are included in the six and a half page index.

COMPETITION AMONG GRAINS.

By N. Jasny. Food Research Institute, Stanford University, Calif. $4.00. 8½ x 5¾; xiii + 606; 1940.

A work destined to be of great value for reference to all those in any way concerned with grains. The author's extensive experience in Russia, Germany, and the United States, and his familiarity with the literature have well fitted him to produce an authoritative survey. The purpose of the study

> is to indicate the major influences responsible for the present distribution of world production and world trade among the individual grains and the major long-run changes in this distribution. To fulfill this task the competitive position of each grain must be studied in the spheres of both consumption and production.
>
> To find space for a rather detailed analysis of both production and marketing phases, the study had to be limited to a few goods only. . . . The term "grain" as here used refers specifically to only five grains: wheat, rye, barley, oats, and corn; and attention is directed principally to the production of these crops for grain rather than for hay, silage, and pasture. The study is furthermore primarily concerned with the occidental parts of the world's temperate zones. Even within this territory, countries not participating in world trade could in general be given only passing attention.

Charts, tables and diagrams exhibit the data effectively and the work concludes with appendix notes and tables and a useful index.

ROCKY MOUNTAIN TREES. *A Handbook of the Native Species with Plates and Distribution Maps.*

By Richard J. Preston, Jr. Iowa State

College Press, Ames. $2.00. 7½ x 5; lxxxi + 285; 1940.

The Rocky Mountain trees for the separate states have been classified in a number of pamphlets but not until the appearance of the present volume have the characteristics of the trees for the entire Rocky Mountain region been gathered into one concise key. Hence this authoritative work fills a real need in the field of forestry.

The text includes discussions of the topography of the Rocky Mountain region as well as the general characteristics of trees. Numerous plates showing the leaf, twig, flower, fruit, and bark of many species, as well as distribution and zone maps, descriptions of botanical and silvical characters, check lists of species by states, and extensive keys, give an indication of the comprehensiveness of the work. The inclusion of all native and naturalized trees of the Rocky Mountain region numbering some 252 species representing 85 genera and 40 families is also indicative of the vast field covered.

A useful glossary, a selected bibliography, and a complete index conclude the volume.

PLANT MICROTECHNIQUE.

By Donald A. Johansen. McGraw-Hill Book Co., New York and London. $4.50. 9 x 6; xi + 523; 1940.

The author states that "the main purpose of the book is to acquaint the user with the principles and procedures of all phases of botanical microtechnique." He succeeds admirably in 500 pages in giving clear, concise directions for the most usable laboratory methods. The first section describes the standard techniques in detail; the second takes up each phylum separately and discusses the special methods that have been developed for handling its members. There is an extensive bibliography. The author has had experience in his own laboratory with the majority of the procedures given, and has much that is pertinent to say on their applications. He also includes a list of sources for living material as well as for apparatus and stains. The botanist of any degree will desire access to this book.

RUBBER LATEX.

By Henry P. Stevens and W. H. Stevens. Chemical Publishing Co., New York. $2.00. 8½ x 5½; 224; 1940.

A study of rubber latex from its source to the various products in which it is utilized. The book contains much information in concise form that should be quite valuable in the laboratories of manufacturers using latex in their products, and who seek to further diversify its application. Data are given on the properties of latex and its composition, also methods of stabilization and manipulation. A chapter is devoted to the process of vulcanization, and subsequent chapters discuss various methods of using latex, and its application in the production of numerous articles. The book further records a long list of British patents applying to its utilization and contains a bibliography comprising books and journals that may be consulted for amplified investigation.

THE HOME BOOK OF TREES AND SHRUBS. *A Layman's Guide to the Design, Planting, and Care of the Home Grounds, with Information on Lawns, Woodlands, Flower Borders, Garden Accessories and the Identification of Trees.*

By J. J. Levison. With an Introduction by Samuel J. Record. Simon and Schuster, New York. $5.00. 10¾ x 7¾; xix + 424; 1940.

This volume will find many enthusiastic readers among amateur gardeners. Specially designed for the layman by a landscape forester of wide experience, it gives the kind of advice most needed by those whose interest in trees and shrubs falls necessarily outside that of the professional. It is a manual and practical guide, giving abundant information on what trees and shrubs to plant under different conditions and in different locations, the propagation and care of these, control of insects and disease, the development and care of

lawns, flower borders, etc. The many beautiful illustrations offer numerous suggestions to the landscapist, and the list of suggested reading is helpful. There is a well-planned index.

HAND-BOOK OF COMMON WATER AND MARSH PLANTS OF INDIA AND BURMA, 1936. *Health Bulletin, No. 24. Malaria Bureau, No. 11.*

By K. Biswas and C. C. Calder. Manager of Publications, Delhi. Rs. 2. 12 or 5s. 9½ x 6¼; xiii + 140 + 6 photographs + 32 plates; 1937.

In order to facilitate the study of the distribution and life history of the parasite-carrying mosquitoes by the officers of the Malaria Survey of India this study of the vegetation and plant associations of tanks, ponds, marshes, etc. has been made. The material is in the form of a handy volume, with a minimum of technical terms, and the keys are so arranged that the principal distinguishing characters come first to notice. A glossary, an index, photographic illustrations, and many line drawings (with detailed explanations) help to make this an extremely useful book for its intended purpose.

MANUAL OF CULTIVATED TREES AND SHRUBS *Hardy in North America: Exclusive of the Subtropical and Warmer Temperate Regions. Second Edition Revised and Enlarged.*

By Alfred Rehder. The Macmillan Company, New York. $10.50. 8½ x 5½; xxx + 996; 1940.

Since the first appearance of this useful reference book thirteen years ago (cf. Q.R.B., Vol. 2, No. 4) many new species and varieties have been introduced into cultivation, new hybrids have appeared, and changes in nomenclature have been made. The present edition has been thoroughly revised and enlarged. In some instances the whole genus has been rewritten. There have been some changes made in the zones of hardiness for plants and a new enlarged map of the zones provided. An invaluable guide to the horticulturalist and all those interested in trees and shrubs.

MICROBES BY THE MILLION.

By Hugh Nicol. Penguin Books, Ltd., Harmondsworth, Middlesex, England. 6d. 7 x 4⅜; 247 + 8 plates; 1939 (paper).

> Imagine that you are one of a party of twenty, and that you are being addressed . . . in the style I use for the more intelligent parties of visitors who come to Rothamsted [Experimental Station] and spend a quarter of an hour or so in the Bacteriology Department during their tour. . . .

This little volume takes the layman on an excursion, and presents him with directions for experiments with bacteria (harmless ones), which can be tried at home.

BASIC COURSE IN BOTANY. *The Foundations of Plant Science.*

By Raymond J. Pool. Ginn and Co., Boston, New York and Chicago. $3.75. 9 x 6; v + 654; 1940.

The material in this text is treated from the broad biological point of view. Wherever possible the subject matter is shown in its relation to agriculture, public health, soil conservation, land management, etc. Text figures (541), a lengthy glossary, and detailed index complete the volume. An excellent text for a well-rounded course in botany.

FLORAL MORPHOLOGY: *A New Outlook with special reference to the Interpretation of the Gynaeceum. Volume One.*

By E. R. Saunders. Chemical Publishing Co., New York. $1.50. 7¼ x 4⅞; viii + 132; 1940.

An American edition of a work that appeared in England in 1937 (cf. Q.R.B., Vol. 13, p. 107). Emphasis is laid on the necessity for supplementing observation of external features by a study of the vascular ground plan. Vol. II, which completes the work begun by Vol. I, has now been issued.

MORPHOLOGY

SCHNELLMETHODEN DER KERN- UND CHROMOSOMENUNTERSUCHUNG.

By Lothar Geitler. Verlag von Gebrüder Borntraeger, Berlin. RM 1.50. 8⅝ x 5½; iv + 27; 1940 (paper).

The writer at the beginning of this monograph points out the difficulties and time consumption attending the older methods of fixation and staining of biological material. The techniques which he treats may be separated into two groups: the aceto-carmine group and the osmicocid group. Carmine dissolved in acetic acid colors intensely the chromatin of the resting nucleus and the chromosomes. The acetic acid acts as a fixative and for this reason the stain is used simultaneously for fixation and coloring. The stain is prepared by mixing 45 parts of acetic acid (conc.) with 55 parts of water (dist.) and to this is added approximately 5 grains of carmine. The solution is weakly heated for ½ to 1 hour. After cooling the solution is filtered. The dye may be modified by using 2 to 3 parts of alcohol (abs.) and 1 part of acetic acid (conc.). In the use of osmic acid as a fixative in connection with the smear procedure a 2 per cent solution of osmic acid is used. The addition of one drop of a 1 per cent chromic acid solution is held to improve the osmic acid solution.

Several modifications and procedures for the use of the foregoing preparations are given. The work contains several illustrations.

GROWTH: *A Journal for Studies of Development and Disease. Supplement. First Symposium on Development and Growth.*

The Editors of Growth, Dairy Building. Cornell University, Ithaca, N. Y. Subscription $5.00 per volume annually (outside U. S. and Canada, $5.50). Single numbers $2.00. 9¾ x 6¾; 111; 1939 (paper).

These proceedings of the first symposium of the *Society for Development and Growth* aim at the integration of knowledge from several branches of biology toward the solution of this problem. The growth of tissues in cultures has shed light on cell division, morphogenesis, and differentiation, as described in a contribution by Warren Lewis. Other articles discuss the chemical factors in growth and development, while several geneticists show the status of genes as evocators of developmental processes. Another method of attack is presented by Oscar Schotté in his lucid account of studies on regeneration of tissues. Finally the evidence from differentiation of higher plants is described by Edmund Sinnott. Certainly such synthesis of knowledge in the attack on biological problems cannot fail in the long run to produce valuable results.

ORIGIN AND DEVELOPMENT OF THE LYMPHATIC SYSTEM IN THE OPOSSUM (*Didelphys marsupialis* L. var. *virginiana* Kerr).

By Arnold A. Zimmermann. University of Illinois Press, Urbana. $2.50 (paper); $3.00 (cloth). 10½ x 7½; 197; 1940.

This detailed study on the origin and development of the lymphatic system in the opossum refutes the Sabin theory on lymphatic genesis (direct centrifugal outgrowth from the venous endothelium) and confirms the mesenchymal origin of the lymphatic system and its genetic independence of the venous system. In addition, new evidence is offered for the refutation of the theory on the venous origin of the jugular lymph sacs. The author utilized the following material: (1) an extensive Wistar Institute collection of sectioned series of opossum embryos ranging from the 8-somite medullary plate stage to birth; (2) sectioned series (Wistar) of two post-natal stages; (3) pouch-young taken directly from a breeding colony (Wistar); and (4) older pouch-young from biological supply houses. There are many graphic reconstructions, photomicrographs, section drawings, photographs, camera lucida drawings, and anatomical sketches. A bibliography is appended.

THE MECHANISM OF THE HUMAN VOICE.

By Robert Curry. Foreword by Douglas Guthrie. Longmans, Green and Co., New

York and Toronto. $3.00. 8 x 5⅜; ix + 205; 1940.

The studies of speech and hearing possess so many facets that few people have a knowledge sufficiently comprehensive to integrate them. The present book is an attempt to bring together the great body of literature dealing with the anatomy, physiology, and acoustics of voice. It is obvious from the length of the volume that a considerable portion of the available information has been omitted. Recognizing this limitation, the author has made an effort to present the more important aspects and to amplify those which are least adequately treated. In addition to detailed accounts of the structure and action of the vocal mechanism, he reviews the experimental methods and results of speech analysis. Further chapters deal with hearing, speech disorders, and the singing voice. The book will be valuable to scientists and teachers whose work concerns the human voice, especially in view of the extensive bibliography which it contains.

ELEMENTARY MICROTECHNIQUE. *Second Edition.*

By H. Alan Peacock. Edward Arnold and Co., London; Longmans, Green and Co., New York. $2.40. 7¼ x 4⅞; viii + 330; 1940.

The value of a book of methods and formulae inexpensive enough to be within the reach of students is evident in the publication of the second edition of this volume. (For review of the first edition, see Q.R.B., II, page 107). The material, including concise discussions of cellular and protoplasmic structure, the principles underlying the use of laboratory instruments, the preparations and uses of stains and media, and even the collection and preservation of living material for study, has been rearranged into a form which the author feels to be more usable. The organization is such that details are easily located. Although the book is intended especially as a text for the beginner, the advanced student will find it a handy working reference.

THE PINEAL ORGAN: *The Comparative Anatomy of Median and Lateral Eyes, with special reference to the Origin of the Pineal Body; and a description of the Human Pineal Organ considered from the Clinical and Surgical Standpoints.*

By Reginald J. Gladstone and Cecil P. G. Wakeley. The Williams & Wilkins Co., Baltimore. $10.00. 9⅝ x 6½; xvi + 528; 1940.

This book is the outcome of a desire to study the pineal body from the broad standpoint of comparative anatomy, and to correlate as far as possible the structural appearance and connections of the mammalian epiphysis with the conflicting views which are held with regard to its origin and functions. The authors hope that the book will be of interest to readers outside as well as within the medical profession and that it will stimulate the study of other organs and systems of the human body from the standpoint of comparative anatomy, in addition to the purely practical aspect. Special care has been taken in selecting and making the numerous illustrations, each of which has an independent explanatory legend. A glossary, bibliography, and an unusually complete index are valuable adjuncts to the book.

THE COMPARATIVE ANATOMY OF THE MAMMARY GLANDS. *With special reference to the udder of cattle.*

By Charles W. Turner. University Co-operative Store, Columbia, Missouri. $3.50. 11 x 8; [6] + 377 + 54 plates; 1939 (paper).

The five sections of this manual (an outgrowth of a mimeographed publication in 1933) are as follows: The gross anatomy of the mammary glands of cattle (6 chapters); Microscopic anatomy of the udder of cattle (4 chapters); The comparative anatomy of the mammary gland (5 chapters; Monotremata through the Rodentia); Anatomy of the mammary glands of the hoofed mammals (6 chapters; swine, goat, sheep, horse, elephant, certain marine mammals); The anatomy of the mammary glands of the Primates

(2 chapters; lemurs, monkeys, apes, and man).

The sections contain tabular matter, illustrations, and bibliographies and references for further study. The volume is published by the offset process and spiral bound. It contains 54 full page plates and is indexed.

BUNDY'S ANATOMY AND PHYSIOLOGY. *Seventh Edition.*

Revised and Edited by S. Dana Weeder. The Blakiston Co., Philadelphia. $2.75. 9 x 6; ix + 490; 1940.

The fact that this work has gone through seven editions sufficiently attests to its acceptance by the teaching profession. It is a clear, concise treatise dealing with the salient points of human anatomy and physiology. Members of the nursing profession will find the book especially helpful. The author has inserted surgical and clinical notes which are correlated with the subject matter of the text. The many tables and illustrations also add much to the text proper.

L'ANATOMIA COMPARATA NEL QUADRO DELLA BIOLOGIA MODERNA.

By Mario F. Canella. Nicola Zanichelli Editore, Bologna. L. 10. 9 x 5¾; xiii + 57; 1937 (paper).

The author begins with the statement that since the beginning of the present century the study of descriptive and comparative anatomy has fallen into discredit, as a biological science, at least in Italy, France, and Germany. The brochure has been prepared in an attempt to rectify this state of affairs, as the author believes that comparative anatomy is, and should be considered, a fundamental part of the biological sciences. His arguments are based on the rôle that a knowledge of comparative anatomy and its techniques play in morphology and physiology. Bibliographical annotations are given.

A TEXTBOOK OF HISTOLOGY. *Eighth Edition.*

By Harvey E. Jordan. D. Appleton-Century Co., New York and London. $7.00. 9½ x 6½; ix + 690; 1940.

This excellent text has become well known since its first appearance in 1916. The present edition (6th edition noticed in Q.R.B., Vol. 6, p. 242) has been thoroughly revised, and the chapter on blood has been completely rewritten. The chapters on technique and laboratory work have been omitted, since the author feels that most teachers now prefer to write their own working directions. The bibliography has been reassembled to include all of the more important publications of recent years.

REPRODUCTION AMONG MAMMALS. *A Guide for Use with the Instructional Sound Film "Reproduction among Mammals."*

Prepared by Melvin Brodshaug and Frederick T. Howard, in collaboration with Herluf H. Strandskov. University of Chicago Press, Chicago. 15 cents. 7¾ x 5¼; iv + 26; 1940 (paper).

This 26-page pamphlet contains the script of the Erpi instructional sound film of the same title, with a few introductory notes and a bibliography. Several diagrams from the film are included with the text. The language is simple, and the story concise and complete. The film is one of those used in the large freshman survey courses at the University of Chicago.

PHYSIOLOGY AND PATHOLOGY

THE ENGLISHMAN'S FOOD. *A History of Five Centuries of English Diet.*

By J. C. Drummond and Anne Wilbraham. Jonathan Cape, London. 12s. 6d. net. 8¾ x 5¾; 574 + 16 plates; 1939.

An extraordinarily interesting book that both the general reader and the food expert will enjoy. The authors (senior author, Professor of Bio-Chemistry in University College) have quite sensibly allowed the technical treatment of the subject to be overshadowed by the his-

torical. Yet the historical is made all the more interesting by being interpreted by specialists. From many different angles the changing character of the English diet during the past five centuries is discussed. It is the bearing which the social and economic conditions have had upon these changes—indeed, the interrelationships of many different factors—that makes this a fascinating book.

Meat, game, and fish formed the main fare in the early days. Since keeping live stock through the winter months was little understood, all but the young and vigorous were slaughtered and dried or pickled for winter consumption. The pigeon-loft furnished fresh meat for the well-to-do; and, of course, game was procurable. As early as the 13th and 14th centuries regulations were formulated prohibiting the cookshops from selling to the poorer classes pies made from tainted meat. Spices were used by all classes either to disguise the strong flavor of meat, or to pep up its insipid taste. Fish, mostly salted and not always when it was exactly fresh, was abundant. Oysters in 1491, were sold for 4 d. a bushel. There are few references to vegetables and fruits in the literature. Cabbage was only used in soups; salads of onions and herbs were popular. Vegetables were supposed to engender wind and melancholy. Butter, by the upper classes was thought only fit to be used in cooking; the poorer classes used it more widely. All classes used a great deal of cheese.

The authors quote freely from the literature throughout the five-century period —from Arthur Young, Pepys, Defoe, Parson Woodforde, Smollett, Burton, André Simon, John Grove, and many others. Among the many topics discussed are changes in physical conditions of the different classes, changing medical views, scurvy, food adulteration, hospital, prison and workhouse diets, food distribution, and finally the great changes in dietetics which have been gradually taking place since the turn of the last century. Scattered throughout the book are illustrations reproduced from different sources. We particularly like the reproduction of the frontispiece from *The Family Oracle of Health* (opposite page 396) where Dr. Kitchiner is about to be arrested "for eating live oysters and thereby contravening Martin's Bill for the Prevention of Cruelty to Animals."

ACCEPTED FOODS *and Their Nutritional Significance. Containing Descriptions of the Products Which Stand Accepted by the Council on Foods of the American Medical Association on September 1, 1939.*

Council on Foods of the American Medical Association, Chicago. $2.00. 8½ x 5⅜; xx + 492; 1939.

The question of the nutritional value of foods is deservedly occupying the attention of those qualified to express an opinion upon it, and this book is a compilation of results attained by the Council on Foods, working under the sponsorship of the American Medical Association. The Council has done excellent work in assembling information on the formulae, vitamin content, chemical analysis, calories, and methods of assembly and treatment of the various food products offered to the public by a goodly number of manufacturers and distributors. It also passes judgment on the nutritional and health claims set forth in the advertising matter that is used to further the sale of different foods. Those organizations, whose products and advertising matter have been passed as satisfactory, are allowed to use the "Seal of Acceptance" as an evidence that their products and advertising matter meet the requirements of the Council. The book contains the names of numerous manufacturers and business houses who have applied for approval of their wares and have had them accepted, but it is noticeable that there are a large number of well-known high grade articles that have presumably not been presented to the Council for acceptance, and one wonders whether the use of the Seal of Acceptance on advertising matter might gradually create a condition of public mind that would be unfair to companies or individuals who have not presented their products for approval, and who might determine, for reasons

satisfactory to themselves, not to ask for this approval. While the immense amount of work done by the Council on Foods is appreciated at its true value, it would seem to have been wiser to have examined and passed on all manufactured and assembled food products, rather than to leave it to individuals to apply to the Council for its approval. As the procedure stands now, in less responsible hands it might conceivably be called a racket.

DYNAMICS OF INFLAMMATION. *An Inquiry into the Mechanism of Infectious Processes. By Valy Menkin. The Macmillan Co., New York.* $4.50. 8½ x 5¾; xii + 244; 1940.

The author has recorded and considered in the light of his own experience observations pertaining to "the disturbed physiological and biochemical equilibria occurring in an area of acute injury." The outstanding phases of inflammation, in order of development, are: (a) increased fluid passage through the capillary endothelial wall, which seems to have two primary factors, elevation in capillary pressure and increased capillary permeability; (b) localization or fixation of the irritant, that is, walling-off of the inflamed area; and (c) migration of leucocytes. The relations between the physical basis of infectious processes and immunity in the organism as a whole have led to the formulation of a dynamic concept of inflammation. Leukotaxine, a crystalline nitrogenous substance released by injured tissue, apparently is concerned with both the migration of leucocytes and the increased capillary permeability. In turn the number and kind of leucocytes which are present influence the rate of metabolism and the hydrogen-ion concentration of the inflamed area. Thus a highly complex mechanism which tends to localize and dispose of a bacterial or chemical irritant is put into action when inflammation sets in. This concept gives a rational interpretation to the rôle of inflammation in immunity.

The author indicates several general lines for further study. Much more work, particularly of a quantitative sort, is certainly needed to clarify the interrelationships of the many factors involved in inflammation.

LIVING LIGHT.

By E. Newton Harvey. Princeton University Press, Princeton. $4.00. 9 x 6; xv + 328; 1940.

To the unspecialized devotee of natural science perhaps the most mysterious phenomenon of nature is that of luminescence. The flashing of fire-flies on a summer evening over a cultivated lawn, or the display of *Medusae* a month later in the ocean, is a familiar sight, yet familiarity in this instance does not breed contempt. When mankind needs artificial light he obtains it from the combustion of material—a wasteful process, but necessary to one who has not learned the secret of luminescence—the production of light without heat.

The greater complexity of living light makes essential a certain amount of knowledge of other forms of luminescence and illumination. A great part of the book is devoted to the experiments of the physicists and chemists of earlier days, such as Boyle, Lavoisier, and Newton. The entire animal and plant kingdoms are then reviewed, as well as experiments upon them, the bibliography of which covers twenty-nine pages with about twenty entries on each page. Organic light is then discussed as to its physics, chemistry, physiology, intensity, efficiency, and color. An idea of the completeness of this discussion may be gained from the fact that the mysterious N-rays, that caused a furore a generation ago, are included. These mythical radiations have no existence whatever; Harvey generously attributes them to an error in technique of the investigator who announced them prematurely. (But when this announcement was made there were many who believed that a deliberate fraud had been perpetrated.)

There are seventeen pages of index, and many excellent illustrations, both photographs and drawings.

PHYSIQUE AND NUTRITION. *A Study of European School Children in Pretoria, Union of South Africa. South African Council for Educational and Social Research Series No. 13.*

By Harding Le Riche. South African Council for Educational and Social Research, Pretoria. (Copies Obtainable from J. L. Schaik, Pretoria). 8½ x 5½; vi + 158; 1940 (paper).

This monograph contains, besides a discussion of methods of studying the nutritional status of a population, the report of an investigation on the frequency of malnutrition in Pretoria (Transvaal) white school children and of an inquiry into the food consumption of a sample of poor families. The author recognizes that the clinical evaluation of malnutrition by visual inspection can be unreliable and prefers to use the more objective A.C.H. index. On the basis of this he finds that between poor and well-to-do children the differences in frequency of malnutrition are not conclusive, that more boys than girls are malnourished, and that the occurrence of malnutrition increases with age. The author's implicit faith in the A.C.H. index is rather surprising since the postulated relationship of this index to nutritional status is not yet accepted. Furthermore, from the author's data it appears that, as many others have shown, the well-to-do children are on the average larger than the poorer children. An examination of the food consumption of poor families reveals below average intake of all the principal food elements. Although the findings reported here are interesting for comparative purposes their evaluation contributes little to the general problem of physique and nutrition.

HEALTH IS WEALTH.

By Paul de Kruif. Harcourt, Brace and Co., New York. $2.00. 8 x 5⅜; ix + 246; 1940.

During a conversation on public health problems between the author and a group of physician friends one evening in 1934, they arrived at the realization that an ounce of prevention being worth a pound of cure to the community could actually be expressed in monetary terms. With admirable faith and ardor they set about to inform the general public of this fact and consequently to formulate a health program of national scope. The main features of this program which apparently won the approval of conservative members of the American Medical Association as well as that of the Surgeon General are: (1) that under the supervision of the U. S. Public Health Service federal aid should be granted to the states for the care of the "medically" indigent; and (2) that once having satisfied certain minimum requirements, the states should be free in the matter of administration of the funds received. Having succeeded in formulating this "non-controversial" program after five years of labor it remained only to receive the presidential blessing and support. In December, 1939, the president consented to receive de Kruif, as spokesman for the group, and to listen to his proposal. Strangely enough, it turned out that notwithstanding his apparent solicitousness for national welfare Mr. Roosevelt was not interested. So the hopes of the author and his coworkers were shattered. This account of the gradual evolution and crystallization of the idea and its popularization through the medium of the author's articles is written with the usual verve that characterizes de Kruif's works.

BLOOD GROUPS. *Reprinted from Tabulae Biologicae, Volumen 17, Pars 2.*

By William C. Boyd. W. Junk, den Haag. 9¾ x 7; 138 + 2 folding plates; 1939 (paper).

The basic facts about blood groups are here presented insofar as possible in tabular form with a minimal amount of text. The first half of the material contains data on the determination of blood groups and on the medico-legal and therapeutic significance of such determinations. Information concerning the chemical and serological nature of the human blood agglutinogens and their relations to those of other species, as well as data on the problem of inheritance of blood groups in man, is presented. The second or anthropological section consists

of tables giving the results obtained by many workers from studies on the frequency of the blood groups and the blood types in various countries, and ethnic groups throughout the world. Maps showing the geographical variations in the frequencies of the blood-group genes, as calculated according to the Bernstein theory from the available data, are included. An enormous quantity of pertinent information has here been condensed into a relatively small space. The bibliography is comprehensive.

EPIDEMIOLOGY IN COUNTRY PRACTICE.

By William N. Pickles. With preface by Major Greenwood. Williams & Wilkins Co., Baltimore. $2.50. 8½ x 5½; viii + 110; 1939.

The complexity of urban life makes it almost impossible to trace an epidemic to its source, while the comparative simplicity of life in rural communities increases the likelihood of finding not only the most recent contacts but the original source of infection as well. The opportunity for the study of infectious diseases in rural areas is well presented in this book. The author is an English country doctor who has published a number of papers on epidemiology. What he has done shows what could be gained by encouraging similar efforts among doctors in the less densely populated regions.

The author points out that, judging from his own experience, epidemiological records collected from many rural practitioners might noticeably modify our ideas on incubation time and duration of infectivity. His studies suggest a program of research that requires neither a big hospital nor a laboratory. The usefulness of such collections of records is easily apparent.

ANNUAL REVIEW OF PHYSIOLOGY. *Volume II.*

Edited by James M. Luck and Victor E. Hall. Annual Reviews, Inc., Stanford University P. O., Calif. $5.00. 8¾ x 6; vii + 501; 1940.

Those of us who find that the best way of keeping in touch with current literature is to make use of review journals, at least for fields other than our own research specialties, will welcome the *Annual Review of Physiology*. Continuing the good work done in the first volume (1939), the editorial committee has again brought together a number of authoritative articles on some of the more actively investigated phases of physiology. Typical articles are those on the Lymphatic system, the Central nervous system, the Pharmacology of barbiturates, and Exercise. All of the articles are fine examples of critical survey. To review each paper separately would be impossible here. It must suffice to say that each is a well-rounded account of the subject which it discusses. The list of references given at the end of each paper is invaluable to anyone who wishes to pursue the subject further. There is also an author and a subject index for the volume.

MORPHINE ADDICTION IN CHIMPANZEES. *Comparative Psychology Monographs. Volume 15, Number 7. Series No. 79.*

By S. D. S. Spragg. The Johns Hopkins Press, Baltimore. $1.75. 10 x 6¾; 132; 1940 (paper).

In this monograph are published the results of an investigation on the nature of morphine addiction in chimpanzees, a species of the anthropoid apes chosen for their close resemblance in behavioral capacities to man, and high degree of intelligent cooperation in experimental procedures. The results of the experiments on morphinism in chimpanzees were compared to functional changes reported in clinical data on morphinism in man. The experiments were carried out on four young chimpanzees (3 males and 1 female) with dosage periods differing for each animal—13 months, 7 months, 4 months, and 6 weeks. During the period of drug administration physiological and behavioral functions in predosage, post-dosage, and "withdrawal" periods were studied, and these results compared with the normal functions in

pre-morphine studies on the same four infrahuman organisms. This type of investigation is of great practical importance in the study of drug addiction in man. Tables, graphs, photographs, and references are included.

THE HEALTH OF THE CHINESE IN AN AMERICAN CITY. *San Francisco.*

By J. C. Geiger, Emmett E. Sappington, Roslyn C. Miller, and Hilda F. Welke. Department of Public Health, San Francisco. 8½ x 5½; 29; 1939 (paper).

This study of the health of the Chinese population of San Francisco is interesting from both the medical and biological standpoint. The general history shown indicates a decidedly bad housing situation, and this, with a probable inclination to resist medical attention and advice, has in the past resulted in unfavorable differences between the Chinese health records and that of the general population. However, over a ten-year period (1929–1938) we find the Chinese death rate sinking below that of the general population, and a remarkable decrease in infant mortality, due partly no doubt to education of Chinese mothers in modern methods of caring for infants. The numerous statistical tables presented and the studies of the effect of environment and national characteristics, which furnish data as to Chinese susceptibility or resistance to various diseases, will be of value to biologists engaged in studies along these lines.

MODERN DIABETIC CARE: *Including Instructions in the Diet and the Use of the Old and New Insulins.*

By Herbert Pollack. Harcourt, Brace and Co., New York. $2.00. 8 x 5⅝; viii + 214 + 4 plates; 1940.

It is rather obvious that in the care and treatment of diabetes mellitus some accumulation of knowledge, by the affected individual, of the causes leading to this disease and a clearer understanding of his physical reactions to its effects, would help considerably in its control, especially when aided by the observations and advice of an intelligent physician. This work is eminently fitted to furnish the diabetic layman with the requisite information, and is couched in language easily understood. The book treats of the causes of diabetes and the most advanced methods of its treatment, and also furnishes a very complete study of diabetic dietetics, in which part Marie V. Kraus is co-author. Physicians can undoubtedly use this publication to advantage and biologists will find information which will possibly be useful in some fields of research—probably in the study of heredity, where in many instances the question is as yet an open one.

DERMATOLOGIC THERAPY IN GENERAL PRACTICE.

By Marion B. Sulzberger and Jack Wolf. The Year Book Publishers, Chicago. $4.50. 8 x 5½; 680; 1940.

This exhaustive text embodies a clearly-written, easily-understood, and precise treatise in which are detailed only those elements of the management of the "commoner" skin diseases and syphilis which will prove practical and useful to every physician. The objective of the book, therefore, is to describe as fully and completely as possible those procedures and medicaments which every physician can promptly apply. The authors are to be commended especially on their judicious selection of topics. This compact "workbench" of dermatology puts the necessary tools in the physician's hands and tells him exactly how to use them to best advantage. Points of special value to note are: 266 tried and proved prescriptions, group photographs to simplify differential diagnosis, step-by-step directions, immediately usable techniques, and time-saving tables and summaries. The volume is indexed and plentifully supplied with illustrations and lists of further references.

A COLLEGE TEXTBOOK OF HYGIENE. *Third Edition.*

By Dean Franklin Smiley and Adrian G.

Gould. The Macmillan Co., New York. $2.50. $8\frac{3}{8}$ x $5\frac{5}{8}$; xiii + 539; 1940.

The earlier editions of this widely-used textbook were reviewed in Vol. 3, p. 590, and in Vol. 10, p. 239. Although the student will still find the subject matter classified under thirteen section headings mostly based upon the various systems of the body, he will note that in this edition for the first time many of the community health problems are discussed in direct association with the presentation of the personal hygiene material. Outstanding changes in the personal hygiene subject matter include a discussion of pneumonia, a new chapter on air conditioning and ventilation, a discussion of appendicitis, and a new chapter on the use of medical services. Bibliographies and references are appended to each chapter. In the appendix the prone pressure method of artificial respiration is given in detail. A glossary of technical terms and an index complete the book.

MÉDICAMENTS ANTIANÉMIQUES ET ANÉMIES EXPÉRIMENTALES.

By Jean Cheymol. Preface by René Hazard. Masson et Cie, Paris. 50 cents. 8 x $5\frac{1}{2}$; [4] + 101; 1940 (paper).

Despite the fact that anemias are among the oldest recognized ailments of mankind, it is only within recent years that any progress has been made in their treatment. The multitude of factors which are involved make these afflictions particularly difficult to study. In this as in other diseases, one of the most fruitful and promising methods of attack is by experimentation on lower animals and application of the results, as far as possible, to man. The initial section of this book discusses mainly the experiments of Whipple, Castle, Minot, and Murphy on the treatment of pernicious anemias by various extracts. The remaining pages describe the experimental introduction of anemias in laboratory animals and the testing of antianemic medication in these diseased forms. This small volume is an excellent compendium of the patient research which thus far has met with only partial success, but holds promise for the future. There is a bibliography of 248 titles.

THE STORY OF DENTISTRY: *from the Dawn of Civilization to the Present.*

By M. D. K. Bremner. Dental Items of Interest Publishing Co., Brooklyn, N. Y.; Henry Kimpton's Medical House, London. $3.75. $9\frac{1}{2}$ x $6\frac{1}{2}$; xix + 211; 1939.

In presenting this unpretentious volume the author makes no claims of originality, but he has obviously accomplished much in compiling this first "complete-in-one-volume" history of dentistry from prehistoric times to the present. This is the first time, also, that dental history has been treated in its relationship to the social and cultural environment. The book is written for the rank and file and not for the chosen few. However, although the story is told in lighter vein, there has been no deviation from the facts as found in the original sources. The simple, nontechnical style of *The Story of Dentistry* recommends it to every intelligent reader who will find much of interest and value between its covers. The volume is supplied with a complete index and is illustrated with photographs and brief biographical sketches of outstanding leaders of the dental profession through the years.

THE FUNDAMENTALS OF PERSONAL HYGIENE: *Including Their Practical Application to Healthful Living. Third Edition, Revised.*

By Walter W. Krueger. W. B. Saunders Co., Philadelphia and London. $1.75. $7\frac{3}{4}$ x $5\frac{1}{4}$; xiv + 304; 1940.

In this revision, the subject matter has been brought abreast of the advancing field of hygiene and altered in other respects to increase its value. Additions and changes have been made on such subjects as the feet, posture, care of the skin, nutritional needs and hygiene, venereal diseases, health fads, the common cold, and tuberculosis. Some of the illustrations have been replaced by new

ones and their total number has been increased. Especially helpful and timely is the excellent chapter on mental health.

DIABETES MELLITUS AND THE JEWISH RACE. *By Ernst Lyon. Ludwig Mayer, Jerusalem.* 8⅝ x 5½; 32; 1940 (paper).

The question as to whether the Jews are more susceptible to diabetes than other races is here presented in an interesting discussion of the subject. The numerous statistical references presented would seem to indicate that Jews, especially in the older age groups, do show a greater percentage of diabetes than other races do, but whether it is a hereditary racial weakness or is due to possible environmental factors is not reasoned out to a definite end. It is quite evident that only continued biological study can eventually answer the question. A reading of this book will furnish some facts useful in further research on the subject.

BIBLIOGRAPHY OF REFERENCES TO THE LITERATURE ON THE MINOR ELEMENTS AND THEIR RELATION TO PLANT AND ANIMAL NUTRITION. *First Supplement to the Third Edition.* *Originally compiled by L. G. Willis. Chilean Nitrate Educational Bureau, New York.* Free. 11 x 8½; 82; 1940 (paper).

BOTANICAL INDEX TO THE THIRD EDITION OF BIBLIOGRAPHY OF REFERENCES TO THE LITERATURE ON THE MINOR ELEMENTS AND THEIR RELATION TO PLANT AND ANIMAL NUTRITION. *Chilean Nitrate Educational Bureau, New York.* Free. 11 x 8½; 24; 1940 (paper).

Instead of complete editions of this important *Bibliography* (cf. third edition, Q.R.B., Vol. 14, p. 491) being prepared as new material accumulates, it is the plan to issue, at approximately yearly intervals, supplements to the third edition which will bring the work up to date. To the indices, which are extremely useful, has been added a botanical index. In order that this index be complete a botanical index to the third edition has also been issued.

TRAITÉ DE LA TRANSFUSION SANGUINE. *By G. Jeanneney and G. Ringenbach. Masson et Cie, Paris.* $2.50. 10 x 6¾; [4] + 386; 1940 (paper).

Drawing from the literature and their own extensive experience, the authors have included: history of the administration of blood transfusions from antiquity to the present time; indications and results; contra-indications; immuno- and cataphylactic transfusions; choice of donor; anticoagulants; preservation of blood for transfusions at a later time; technique and apparatus; accidents during and after the administration, their causes and treatment; modes of action and behavior of transfusion; organization of blood transfusion centers, including those of the battlefield; and special problems of technique, medico-legal aspects, etc. The bibliography, arranged by subjects, covers 19 pages. The book is illustrated.

MALNUTRITION IN SOUTH AFRICA. *By Ellen M. Radloff and T. W. B. Osborn. The Witwatersrand University Press, Johannesburg.* 2s. 10½ x 9; [2] + 29 + 4 tables; 1939 (paper).

Although a few pages of this book are devoted to dietary deficiencies in South Africa, in the main it discusses malnutrition generally. In Africa, as in other parts of the world, the problem is not that the people fail to get a sufficient quantity of food, but the proper chemical and vitamin constituents are lacking. The first section of the book outlines the principal dietary essentials, following which is a comparison of several South African diets to what may be considered a normal allowance. A number of suggestions are offered as to the methods by which malnutrition might be remedied.

LA SÉNESCENCE ET LE RAJEUNISSEMENT. *Traduction libre de l'allemand.* *By Paul Niehans. Vigot Frères, Paris.* 8⅓ x 6; 72; 1937 (paper).

Only a third of this book treats the processes of human senescence; the rest is devoted to an exposition of the various methods

for rejuvenation propounded by Voronoff, Steinach, Slotopolsky, the present author, and others, and the advocation of the use of the different methods (hormone treatment, glandular transplants and grafts, ligation, etc.) according to the various indications. The author concludes with a plea that physicians concentrate their efforts as much toward combating the discomforts of old age as they do to combating disease. The work is a translation from the German. It has no bibliography.

BIOCHEMISTRY

BIOCHEMISTRY OF DISEASE.

By Meyer Bodansky and Oscar Bodansky. The Macmillan Co., New York. $8.00. 9¼ x 6⅛; viii + 684; 1940.

The increasingly important position of biochemistry in medicine makes this a book of exceptional interest to all who deal with man's ills. In many instances the difference between normal and pathological conditions in the human body is very slight. Frequently an altered biochemical reaction is one of the earliest indications of disorder, and in almost every disease the biochemist's report is an important part of the case history. In this book the authors have brought together the latest biochemical information on many diseases. The viewpoint is that of the clinician. Laboratory techniques are included only when the coöperation of the physician is necessary to complete the test. Practical applications of recent research are given in full. In order to make specific details more readily available to the busy medical man the material is divided into sections on the various organs and organ systems, and on such general topics as disorders of nutrition, and metabolism, and the biochemical aspects of neurologic and psychiatric disorders.

TRAITÉ DE CHIMIE ORGANIQUE. *Tome VI. Glycols, Glycérols et Alcools Polyvalents Supérieurs, Phénols et Polyphénols, Phénols-Alcools, Dérivés Sulfurés, Séléniés ou Tellurés Correspondant aux Alcools ou aux Phénols, Développateurs Photographiques Organiques, Industries des Phénols.*

By J. Amiel, P. Baud, R. Delaby, G. Laude, P. Pascal, Ch. Prévost, A. Seyewetz and M. Tiffeneau. Published under the Direction of Victor Grignard, G. Dupont, R. Locquin and Paul Baud. Masson et Cie, Paris. $8.45 (paper); $9.10 (cloth). 9¾ x 6½; xix + 1182; 1940.

TRAITÉ DE CHIMIE ORGANIQUE. *Tome IX. Monoacides, Éthers-Sels, Industries des Produits Acétiques et des Produits Méthyliques.*

By J. Aboulenc, J. Lichtenberger, J. B. Senderens and R. Truchet. Published under the Direction of Victor Grignard, G. Dupont, R. Locquin and Paul Baud. Masson et Cie, Paris. $6.25 (paper); $6.85 (cloth). 9¾ x 6½; xix + 831; 1940.

These are the sixth and ninth volumes of an extensive set. The high standards which mark the preceding works reviewed in this journal have been maintained throughout the present pages. Each volume is thoroughly indexed and contains complete bibliographies on the various subjects which are listed in the titles above.

ANNUAL REVIEW OF BIOCHEMISTRY. *Volume IX.*

Edited by James M. Luck and James H. C. Smith. Annual Reviews, Stanford University P.O., Calif. $5.00. 8¾ x 6; ix + 744; 1940.

In spite of the many difficulties under which the present volume has been prepared—foreign contributors working under adverse conditions, material lost or delayed in the mails, etc.—this volume maintains the high standard of its companions and presents many interesting sections. We always regret that the limited space available prohibits a detailed review. As usual, it is only possible to list a few papers and we have selected for this occasion those of special interest to the general biologist: Plant pigments, by G. Mackinney; Aspects of inorganic metabolism in plants, by C. B. Lipman; Soil microbiology, by S. A. Waksman; Organic acids of plants, by H. B. Vickery and G. W. Pucher; Biochemistry of the lower fungi, by H.

Raistrick; Insect biochemistry, by R. Craig and W. M. Hoskins; Application of radioactive indicators in biology, by G. Hevesy.

The extent of the total documentation of the volume is indicated by the length of the author index. This covers 27½ pages, many of the names being followed by several page references. The subject index covers 26 pages, and again, many subjects have more than one page reference.

DIE METHODEN DER FERMENTFORSCHUNG. *Lieferung 1.*

Edited by Eugen Bamann and Karl Myrbäck. Georg Thieme Verlag, Leipzig. RM. 18. 11 x 8; ix + 172; 1940 (paper).

This is the first number of an important, comprehensive work on the enzymes, with an international list of contributors, which will ultimately comprise about 3,500 pages. The present number treats the substrates (substrates of ester splitting enzymes and part of the material on the biologically important carbohydrates and glycosides). A bibliography of 6,000 titles to the completed work is promised.

UNIVERSITY OF COLORADO STUDIES. *Series D. Physical and Biological Sciences, Volume 1, Number 1. A Group of Papers from the Department of Chemistry.*

University of Colorado, Boulder, Colorado. $1.00. 10 x 6¾; 69; 1940 (paper).

SEX

TRANSITION YEARS. *The Modern Approach to 'the Change' in Womanhood.*

By Joseph Rety. Greenberg, Publisher, New York. $1.75. 8 x 5¼; 168; 1940.

The author, a gynecologist of four decades of experience, has written a straightforward account of the climacteric, the "change of life" in woman, and the concomitant alterations in mental and physical makeup. These latter changes, especially mental, need not be at all disturbing, but due to faulty knowledge and ignorance this period is looked upon with acute fear by many women. The author points out that fear is one of the most serious problems of the climacteric. "All others can be dealt with by simple means as diet, exercise, self-control and, where necessary, an up-to-date medicament." There is a general outline covering the physical and psychological "troubles" which may accompany the change, the symptoms of such troubles, their relation to the climacteric, and the treatment of these ailments—especially the use of ovarian and thyroid extracts. This account, addressed to all women and written mainly in narrative style, presents an excellent and unalarming survey of the period which so many women face and undergo with unnecessary fear.

YOUR MARRIAGE: *A Guide to Happiness.*

By Norman E. Himes. Farrar and Rinehart, New York and Toronto. $3.75. 8⅛ x 5½; xiv + 434; 1940.

Most books on sex and marriage within recent years have taken an extremist viewpoint. The writers have been either zealous reformers or advocates of free love. It is some consolation occasionally to find a book, such as this, which is entirely rational and will serve as a guide to young people. Although the author discusses the sexual and reproductive aspects of marriage, large portions of the volume are devoted to social and economic factors. Of particular value are the sections dealing with consumer guidance, budgets, insurance, credit, and buying or renting a home.

The author favors earlier marriages as a solution to several present day problems, particularly to those resulting from premarital sexual tension. However, early marriages introduce other problems perhaps equally serious. Many people will disagree with this and other viewpoints expressed throughout this volume, but by and large it should prove to be a most useful guide.

SEXUAL DISORDERS IN THE MALE.

By Kenneth Walker and Eric B. Strauss. With a Foreword by Sir Walter Langdon-

Brown. Williams & Wilkins Co., Baltimore. $3.00. 8¼ x 5¼; xiv + 248; 1939.

This book is offered as a practical manual for the general practitioner and the medical student. In it the common male sexual disorders are discussed from the point of view of diagnosis and practical treatment. Both psychological and physical underlying factors are considered, the former being recognized as the most frequent etiologically. It is unfortunate, therefore, that the book is able to give so little real understanding of how the psychological aspect is to be handled, and that so much space is devoted to descriptions of physical measures. There is a list of references and an index.

SEX IN MARRIAGE.

By Ernest R. Groves and Gladys H. Groves. Emerson Books, New York. $2.00 7⅜ x 5; 250; 1940.

This is not "just another sex book." The senior author, Professor of Sociology at the University of North Carolina, has long been a serious student of the problems of family life—to him is credited the first college course dealing with such questions. Mrs. Groves has ably assisted her husband in his work. In general, this edition differs little from the earlier one which was written "to give briefly and clearly information which an experience of twenty years in dealing with family problems has led the authors to think most useful in helping young people meet the sex demands of marriage."

BIOMETRY

ELEMENTI PER UNA TEORIA MATEMATICA DEL CONTAGIO.

By Marcello Puma. Editoriale Aeronautica, Roma. L. 13. 7¼ x 5; 200 + 9 folding charts; 1939 (paper).

The well-known differential equation of growth is developed here and applied to the spread of contagion in a collectivity. The author examines briefly the modifications of the general equation depending upon the conditions postulated, such as, a closed or open community; immune, partially immune, or non-immune populations; direct or indirect contagion, etc. Although theoretical and elementary, this book outlines very clearly the fundamental concepts of a mathematical treatment of epidemics.

INTRODUCTION TO MEDICAL BIOMETRY AND STATISTICS. *Third Edition, Revised and Enlarged.*

By Raymond Pearl. W. B. Saunders Co., Philadelphia and London. $7.00. 9¼ x 6⅛; xv + 537; 1940.

This edition of a widely used text has been extensively revised. Material that the general progress of the subject has rendered no longer useful has been omitted, giving space for new matter. Many new illustrations and tables have been added, and also a new chapter on the measurement of variation. Altogether the book has been increased in size by nearly 80 pages.

THE BULLETIN OF MATHEMATICAL BIOPHYSICS. *Volume 2, Number 4, December, 1940.*

Edited by N. Rashevsky. Editorial and Publication Offices, 5822 Drexel Avenue, Chicago.

This number contains the following papers: Some general theorems of the motion of incompressible viscous fluids, by G. Young; A neural mechanism for discrimination III. Visually perceived lengths and distances, by A. S. Householder; Deformation of shell shaped cellular aggregates; Application to gastrulation, by N. Rashevsky; Some considerations on mathematical molecular biophysics, by N. Rashevsky; Index for Volume 2.

PSYCHOLOGY AND BEHAVIOR

EXPLORATIONS IN PERSONALITY. *A Clinical and Experimental Study of Fifty Men of College Age. Harvard Psychological Clinic.*

By Henry A. Murray. Oxford University

Press, New York, London and Toronto. $8.50. 9¼ x 6⅛; xiv + 761; 1938.

This book presents a detailed and technical account of the most original, thoroughgoing, and systematic attempt at a consistently scientific appraisal and understanding of human personality that has yet been made. It is a collaborative effort of a group of persons, in respect of both the observational and experimental work upon which the account is based, and the actual writing of the book. But to Murray, the planner, director, analyst, and synthesizer of the investigation clearly belongs the major part of the credit for the success and significance of the outcome. The studies were made on 51 male subjects of college age. Eleven were drawn from the ranks of the unemployed. The remainder were students, all chosen by the Harvard Employment Office, with equal representation of high and low scholarship, and paid the current wage for their service as subjects. They were "normal" persons, in the usual and conventional sense that they had not been regarded as, or accused of being, either more or less crazy than the general run of mankind.

These subjects were put through a series of carefully and thoroughly planned examinations, experiments, interviews, and tests widely ranging in their comprehensiveness. It is safe to say that no such number of "normal" human beings have ever been so thoroughly and completely studied in respect of their total personalities as these were.

The primary purpose of the study was methodological, and in this respect the net result is of first rate importance. A methodology has been developed that, even though far from being yet perfected, will yield rich and novel rewards to the psychologist and psychiatrist if it is consistently and intelligently employed. Specifically in the present case it has yielded a composite picture of the present day individual of college age that is clear-cut and illuminating within its defined boundaries.

The book is so packed with technical detail in both its theoretical and objective aspects as to make any summary of findings impossible in the space here available. But every student of human biology, whatever his special field of interest, will wish to read and study it. For it is a contribution belonging in the absolutely first rank of significance. There is included at the end a glossary of terms used, which the reader will find extremely useful, and a competent index.

SOCIAL AND BIOLOGICAL ASPECTS OF MENTAL DISEASE.

By Benjamin Malzberg. State Hospitals Press, Utica, N. Y. $2.50. 9½ x 6¼; 360; 1940.

This very interesting statistical survey is based on standardized data recorded on patients with mental disease in New York State since 1890. In the first chapter the trends of mental disease in New York State are investigated, and the general conclusion reached that a relative increase in such diseases exists. It is noted that this does not necessarily imply an increase in the number of defective family stocks, but is consistent with the degree and rapidity of social changes which have occurred in recent generations—a constructive viewpoint for mental hygiene. In the second chapter the relationship between age and mental disease is considered. It is pointed out that the natural sequence of mental diseases through the different age periods—dementia praecox and manic-depressive psychoses in the early periods of life, general paresis and alcoholic psychoses in the middle period, and senility and arteriosclerotic psychoses in the later period—is an important consideration in planning a mental hygiene program. In the third chapter mental disease in urban and rural populations is compared. In Chapter IV, marital status in relation to mental disease is discussed. Except for general paresis, the incidence of mental disease is found to be higher in the single than in any other group, but it is pointed out that the marital status probably represents selection on the basis of mental characteristics. In Chapter VII, "Race and mental disease," particularly interesting findings occur. It is found that the Irish show by far the highest rate of first admissions—due primarily to

mental diseases associated with old age and with alcoholic addiction. The Scandinavians rank second, ranking high in general paresis and alcoholic psychoses. Germans, Italians, and English follow in the order named. It is stressed that cultural factors must be considered in any interpretation of these findings, and that racial factors alone may be misleading. In Chapter X, "Mental disease among Negroes," it is shown that the ratio of first admissions in Negroes as compared with whites is 2 to 1. Dementia praecox is the leading psychosis, with general paresis ranking second, manic-depressive psychosis third, alcoholic psychoses fourth. In Chapter XI, economic factors in relation to mental disease are considered. In the twelfth chapter it is found that illiterates have higher rates of first admissions than literates. It is not felt, however, that illiteracy and mental disease are causally related, but that both arise from the same social conditions. In Chapter XIII, it is found that mortality rates at corresponding ages are from 3 to 6 times as great among patients with mental disease as among the general population. This heavy mortality results in a reduction of approximately 18 years and 14 years in the life span of the male and female patients, respectively. In the fourteenth chapter, the efficacy of insulin shock therapy in dementia praecox is evaluated. It is reported that, following termination of treatment, 12.9 percent of the patients were reported recovered and 65.4 percent improved. One year after termination of treatment, all of the recovered patients were still recovered and 49.0 percent were still improved. In untreated cases the recovery rate was only 4 percent and the improved rate 11 percent. Paranoid and catatonic types showed better results than hebephrenics, and short duration of illness before treatment was a favorable factor.

The data on which the conclusions are based in each chapter are included in tabular form and the results of analysis shown in simple, lucid graphs. The discussion is presented briefly and concisely. There is a bibliography and an index.

LE SYNDROME DE DÉSINTÉGRATION PHONÉTIQUE DANS L'APHASIE.

By Th. Alajouanine, André Ombredane, and Marguerite Durand. Masson et Cie, Paris. 80 cents. 9 x 6; 138; 1939 (paper).

Four cases in which aphasia accompanied paralysis of the right side were each observed and treated by the authors over a number of years. Although the results of the usual neurologic examinations, psychologic, and reflex tests are presented for each of these patients, it is with the phonetic defects that the authors are particularly concerned. Although the mutations in the pronunciation of words differed with the patients some of the fairly consistent tendencies included the use of a lip stop consonant at the beginning of words, the substitution of buccal vowels for nasal, such as *da* for *dans*; supression of *r*, especially when it should be vibrant, or its substitution by a liquid, e.g. Lobé for Robert [the illustrative words are, of course, French throughout the book]; the substitution of hard consonants for soft, such as *pépé* for *bébé*; etc. One of the patients made few mistakes in spelling, word order, or grammar when putting into writing sentences which were spoken to her, or in giving in writing resumés of anecdotes and stories in pictures. The other three, in similar tests, elided syllables, transposed letters, and made other errors in spelling and grammar. None of these written products, however, resembled in their errors the phonetic mutations of the same material when given orally. In general the oral "phonetic disintegration" appeared to manifest itself in a reversion to a "primitive" mode of articulation resembling the first efforts of a child learning to talk.

A brief theoretical discussion as to the cause of this malady and suggestions for reeducation in speaking and writing, with which the authors have had some success, are included. The illustrations consist of graphic representations of lip and laryngeal movements in the pronunciation of certain words as made by normal persons and the patients, as registered on Rousselot's cylinders.

THE VARIETIES OF HUMAN PHYSIQUE: *An Introduction to Constitutional Psychology.*

By W. H. Sheldon with the collaboration of S. S. Stevens and W. B. Tucker. Harper and Bros., New York and London. $4.50.

9⅛ x 6¼; xii + 347 + 45 plates; 1940.

The major portion of this book is devoted to outlining a method of classifying and grading body build. The approach described is two-fold. First, by visual inspection of photographs the amount of the endomorphic, mesomorphic, and ectomorphic component, respectively, of the body and of its divisions is estimated on a seven-point scale. This estimate for the body as a whole is supplemented by the value derived from the use of the index: stature divided by cube root of weight, and for other body segments by the values of indices calculated from measurements taken on the photographs. After averaging in a number of ways the estimate and the computed indices, a single index such as, for example, 425 is finally obtained. This index supposedly reveals that in the particular subject the endomorphic component equals 4, the mesomorphic 2, and the endomorphic 5. In the usual terms of constitutional somatology this subject would be described as an asthenic—intermediate, or a flaccid asthenic. According to the scheme of the authors there are 343 possible somatotypes, ranging from 111 (!) to 777 (!) but only 76 have been observed in 4000 male college students. The authors deserve praise for the ingenuity displayed although their index does not differ substantially from others based on combined mensurational and impressionistic techniques. On practical and rational grounds they have all proven unsatisfactory. A successful solution of the problem of somatotyping is essential to the further progress of constitutional somatology but until the problem is more clearly understood than so far has been the case, the classification of physical types must still be determined by some anthropometric indices or on the basis of the temperament types described centuries ago and to which the authors have also had recourse.

GETTING MORE OUT OF LIFE.

By Joseph Jastrow. Emerson Books, New York. $2.00. 8 x 5½; viii + 312; 1940.

Although the reference of certain British physicians of the old, or thick-skulled school to a nervous breakdown as an "American luxury" is a slight exaggeration of the facts, there is sufficient mental instability among all classes of society to warrant an increase in the number of psychiatric clinics, as well as an increase in the number of psychology books for the masses by such level-headed psychologists as Jastrow. Until the layman has become thoroughly acquainted with the capabilities and limitations placed upon him by his heredity and his environment, there will remain many psychological mis-fits in our various branches of society. After a person has gained some idea of his own psychological assets and liabilities, the next step in his training to get more out of life is the dispelling of fears, signs, beliefs, and superstitions. The third step to the threshold of happy living is a recognition of the interdependence of mind and body. Jastrow believes that

"In the near future medicine will recognize *psychosomatics* as the study of mental action on bodily states in health and disease" and that "There are all sorts of difficulties which only the knife can remove; but in every case the total patient must be considered and a goodly part of him is his mental attitude in disease." He also agrees with a wise British doctor that "When a man is so ill that he thinks he is ill when he is not ill at all, then he is very ill indeed."

The book is written in a stimulating and quite readable manner, and is replete with cases from the author's files. There is a table of contents, but no index.

MATHEMATICO-DEDUCTIVE THEORY OF ROTE LEARNING. *A Study in Scientific Methodology. Published for the Institute of Human Relations.*

By Clark L. Hull, Carl I. Hovland, Robert T. Ross, Marshall Hall, Donald T. Perkins and Frederic B. Fitch. Yale University Press, New Haven; Oxford University Press, London. $3.50. 9¼ x 6⅛; xii + 329; 1940.

The theory of rote learning set forth in

these pages represents the coordinated effort of psychologists and mathematicians. "While it is believed by the authors that the present monograph contributes to an understanding of the learning processes, it is judged that its chief value consists in the large-scale pioneering demonstration of the logico-empirical methodology in the field of behavior." Scientific development is constituted of the relationship between observations and ideas. The experimental procedure used in obtaining the observed facts of rote learning is described, definitions are given, and a set of postulates is developed. The theoretical system is made up of numerous theorems derived from these definitions and postulates, and couched in the symbolism of mathematics and logic. Theorems are then checked against the observed data and are found in some cases to be inadequate, although on the whole they have been experimentally verified. The authors express the belief that by utilizing the methodology presented in this volume the social sciences may eventually attain the predictive power which characterizes the physical sciences. However, until such specialists as were engaged in the present work further demonstrate the general applicability of the system, it is doubtful if it will command the attention of but a few individuals.

NEGRO CRIME. *Comparative Psychology Monographs. Volume 16, Number 2. Serial Number 81.*

By Jess Spirer. The Johns Hopkins Press, Baltimore. $1.25. 10 x 6⅞; 64; 1940 (paper).

This study of Negro crime is based on the commitment records of the Western State Penitentiary, Pittsburgh, Pennsylvania, between 1906 and 1935. It is found that when proportional incidence of population is taken into consideration, Negroes have been committed to the penitentiary 9.69 times as frequently as native whites. The highest proportional commitment is found for crimes of violence (murder and assault) for which Negroes were committed 29.06 times as frequently as native whites. Possible explanations of this proportionally large number of commitments among Negroes are discussed and the conclusion reached that it cannot be entirely accounted for by (a) the presence of proportionately more males in the Negro population, (b) the presence of proportionately more males in the crime committing ages in the Negro population, (c) the presence of Negroes who are not native-born Pennsylvanians, or (d) the concentration of Negro populations in industrial areas. It is likewise concluded that there is insufficient evidence to ascribe to the Negro a biological inferiority to account for his so-called "criminality." There is a bibliography of 110 titles.

A STUDY OF EXPERIMENTALLY INDUCED COMPETITIVE BEHAVIOR IN THE WHITE RAT. *Comparative Psychology Monographs. Volume 15, Number 6. Serial No. 78.*

By Charles N. Winslow. The Johns Hopkins Press, Baltimore. 75 cents. 10 x 6⅞; 35, 1940 (paper).

The writer proposed to attempt to answer several questions as to the effect which competition has on the rat. To this end three experiments were set up in which first singly and then in pairs the animals (1) ran over a straight course to a visible food reward; (2) ran mazes to the reward; and (3) pulled the reward from above by means of a pulley. The writer concludes that "Rats respond competitively to one another when they are rivals for a single piece of food" and that the animals may respond in one of two ways; either by an increased effort or by inhibition as a result of frustration at losing. Inasmuch as two rats would often fight over the food if they both arrived at the same time there was obvious competition. But from the writer's statements as to the initial behavior of the animals upon release, coupled with the lack of statistical significance of the differences in competitive and non-competitive times, it would appear that by and large the rats just did not know what it was all about.

THE FIRST FIVE YEARS OF LIFE. *A Guide to the Study of the Preschool Child. From the Yale Clinic of Child Development.*

Part One by Arnold Gesell; Part Two by Henry M. Halverson, Helen Thompson, Frances L. Ilg, Burton M. Castner and Louise B. Ames; Part Three by Arnold Gesell and Catherine S. Amatruda. Harper and Bros., New York and London. $3.50. 9⅛ x 6¼; xiii + 394 + 21 plates; 1940.

Gesell and his associates summarize their views and conclusions on the behavioristic development of children from birth to six years of age. In the first part of the book a general picture is given of the typical pattern of motor responses and adaption, language and person-social behavior traits at different stages in infancy and early childhood. Included are a series of beautiful photographic illustrations of the type found in Gesell's principal publications. In the second part of the book a detailed discussion is presented of the development of each of the above characteristics. The third part contains an outline of the method and technique of examination. It is needless to say that this is probably the most authoritative and comprehensive work on a subject in which the work of the author and his group have been greatly responsible for such progess as has been made.

SELECTED WRITINGS OF SIR CHARLES SHERRINGTON. *A Testimonial Presented by the Neurologists Forming the Guarantors of the Journal Brain.*

Compiled and Edited by D. Denny-Brown. Paul B. Hoeber, Medical Book Department of Harper and Bros., New York. $7.50. 9¾ x 7¼; xiv + 532; 1940.

This compilation at once pays tribute to the genius of Sir Charles Sherrington and serves as an excellent reference book for neurologists, physiologists, and psychologists. No pretense is made to cover the entire range of contributions, but the selection offers those papers which are of greatest interest to workers in these fields. An effort has been made to give the volume chronological continuity as well as an orderly arrangement of the subjects treated. The reprints and extracts include discussion of motor and sensory innervation, spinal and bulbar reflex activity, postural reflexes, reciprocal innervation, the motor cortex, and the nature of reflex excitation and inhibition. The entire volume represents a masterful piece of work in editing and compiling this vast body of material. Following the text is a complete bibliography of Sherrington's papers and a thorough index.

DIE TIERISCHEN INSTINKTE UND IHR UMBAU DURCH ERFAHRUNG. *Eine Einführung in die Allgemeine Tierpsychologie.*

By J. A. Bierens de Haan. E. J. Brill, Leiden. 8 guilders (paper); 10 guilders (cloth). 9¾ x 6¼; xi + 478; 1940.

The author has rendered a service to psychologists in bringing under one cover the work of numerous laboratories in an effort to synthesize an understanding of the processes of instincts, their changes through experience and learning, and their place in the total personality of animals. After a general discussion and an ordering of the more important instincts the author attempts to find out whether the instincts are endowed with "plasticity and elasticity." From the published literature and his own researches he concludes that they are, and may be manifested in variations, adaptations, and regulatory processes. He further affirms that some can also be influenced by training and imitation.

The bibliography covers 35 pages, and an index of authors and one of animals has been provided.

STUDIES OF ABNORMAL BEHAVIOR IN THE RAT. *II. A Comparison of Some Convulsion-Producing Situations. Comparative Psychology Monographs. Volume 16, No. 1.*

By Norman R. F. Maier and Nathan M. Glaser. The Johns Hopkins Press, Baltimore. 75 cents. 10 x 6¾; 30; 1940 (paper).

There have been a number of experiments which demonstrate the occurrence of

paroxysms in animals as a result of certain types of auditory stimulation. The present study was designed to determine to what extent the behavior abnormalities are related, and to offer possible explanations. The stimuli (jingling keys, hissing air, bell, buzzers, and whistle) were given to the rats under varying degrees of confinement and conflict-producing conditions. Several interesting findings are reported, chief among which is the increase in frequency of convulsions when the rats are involved in a conflict situation to which they have no adequate response. The study is well planned and clearly presented, but is open to criticism in respect to the small number of animals in the experiments.

COMPARATIVE PSYCHOLOGY: *A Comprehensive Treatise. Volume II, Plants and Invertebrates.*

By Carl J. Warden, Thomas N. Jenkins and Lucien H. Warner. The Ronald Press, New York. $6.00. $8\frac{3}{8}$ x $5\frac{3}{4}$; xiii + 1070; 1940.

This book represents a compendium of the literature on plant and invertebrate comparative psychology and behavior, and contains a staggering list of references which covers 213 pages. The material in each chapter is organized under two broad headings: receptive capacities and reactive capacities of the ground under consideration. The material has been well digested and is concisely summarized. An invaluable source book for the biologist who is interested in more than the morphological side of his subject. There is a subject and author index.

DE OMNIBUS REBUS ET QUIBUSDEM ALIIS

HISTORY AND SCIENCE: *A Study of the Relation of Historical and Theoretical Knowledge.*

By Hugh Miller. University of California Press, Berkeley. $2.00. $8\frac{1}{2}$ x $5\frac{1}{2}$; x + 201; 1939.

This is a philosophical discussion of two fields of intellectual exploration, as restricted by the author's own definitions. Science he limits to the study of things that occupy space, and History he expands to the study of Processes that occupy time. It was Darwin's epoch making book that caused the scientists of subsequent generations to become time-conscious; previous to Darwin all science was purely descriptive and entirely devoid of any tendency to draw inferences by which the future might be forecast.

For this reason, according to the author, Darwin and his satellites are not so much historically-minded scientists as they are scientifically-minded historians. This seems a mere verbal quibble at first, especially when we recall that modern relativity physics bids fair to accomplish the synthesis of time and space, if indeed it has not already done so. Also the author believes that the philosophy of the historian is more likely to be empiric than that of the scientist. This is surprising for one would naturally think that a philosophy limited to the contemplation of things would be empiric rather than one devoted to the contemplation of processes which can be apprehended only by observing things and drawing inferences from the changes wrought in them by time. But this supposition the author most emphatically denies. It is difficult to follow his logic, but the reader who endeavors to follow honestly the author's thought is likely to be converted by the essentially sane and healthy conclusions to which the author leads him before he gets half-way through the book.

Perhaps most readers will feel that the chapter dealing with the relation of history and religion is the most vital in the entire work, especially in view of the strange tendency today among representatives of organized religion to derive aid and comfort from Heisenberg's uncertainty principle. This tendency seems more pronounced among those whose understanding of Heisenberg is least, and its implication is that religion can flourish better in a chaotic than in an orderly universe.

Miller says nothing about Heisenberg but his discussion of the historical aspect of religious development leaves no doubt as to where he stands. Primitive peoples

have developed religion only insofar as they have been able to perceive unifying principles in the univserse. They pray for favor to anthropomorphic personifications of these principles. There would be no point to prayer in a universe so chaotic that all happenings were fortuitous. The theory of evolution, by making the scientific mind time-conscious and also by accentuating the unity of the universe, has served to check rather than to accelerate the *Götterdämmerung* of Christianity; notwithstanding the statements of certain shallow-minded ecclesiasts who attribute to the theory the materialism of the nineteenth century.

The closing chapters dealing with democracy and progress are also vitally significant and it is to be hoped that this work will receive the attention that it merits, for it is a really valuable contribution to modern scientific and philosophic thought. Unfortunately it has no index.

THE WANDERING LAKE.

By Sven Hedin. Translated from the Swedish by F. H. Lyon. E. P. Dutton and Co., New York. $3.75. $9\frac{3}{8}$ x $6\frac{1}{4}$; x + 291 + 31 plates; 1940.

Sven Hedin's name has become so well known through earlier books of his that no special introduction is necessary here, but the title of the present work is misleading and requires some explanation.

The lake of Lop-Nor was fed by the Konche-daria, and has no outlet but by evaporation. Some distance above the lake the river is divided as if by a delta, but the two arms so formed never unite again. The other branch is the Kum-daria, which at the time of the author's first visit to this part of Central Asia in the last century was quite dry. It terminated in a sink. Any one accustomed to the vagaries of rivers in desert countries, like our own Colorado as de Niza and Kina saw it, before its spirit was broken by the harness of dykes and levees that now restrain it, can readily understand how the flow of such a stream might alternate between the two arms of the delta, and if each arm led to its own sink there would be two lakes, which would alternate in receiving the flow of the water. The lake of Lop-nor was two independent lakes that existed not simultaneously but alternately.

Sven Hedin's story is of interest not because it is the report of a strange natural phenomenon, but because on visiting the area in 1900 he prophesied that in the next generation the stream would shift beds again for the first time since the year 330 A.D. On his return in 1934 he found his prophecy fulfilled. Since the lake occupies a position of extreme inaccessibility in the plateau of Central Asia, seldom visited by white men, the story is of great interest and importance, and the numerous illustrations, by the author, add much to it. It is well indexed and has several maps.

SCIENCE FRONT 1939.

By F. Sherwood Taylor. Cassell and Co., London, Toronto, Melbourne and Sydney; The Macmillan Co., New York. 7s. 6d. net in England; $2.50 in America. $7\frac{3}{8}$ x 5; 301 + 8 plates; 1939.

The *Science Front* of 1939 was so broad that it was nearly impossible for one reporter to cover it entirely, but this is an admirable attempt. The clarity and precision with which are discussed such technical topics as chemotherapy, sex and the steroids, television, the atom, the treatment of cancer, schizophrenia, the aurora borealis, plant growth substances, and the universe, is commendable. For anyone beyond the age of 16, whether his interests lie in biology, chemistry, physics, medicine, astronomy, or radio, this book will prove to be as fascinating as it is informative.

In discussing such vast topics—about any one of which countless volumes can be, and have been, written—it is impossible to develop the entire field. The discussions are restricted to the most recent discoveries, developments, theories, aspirations, and lines of research in the various subjects. When the scientific advancements of the past decade are compared with those of the previous five decades,

the astoundingly accelerating pace of science is fully realized.

The textual material is well supplied with formulae, charts, graphs, drawings, and photographs, and is provided with a complete index.

THE CHICAGO COLLEGE PLAN. *By Chauncey S. Boucher. Revised and Enlarged after Ten Years' Operation of the Plan by A. J. Brumbaugh. University of Chicago Press, Chicago.* $3.00. 8 x 5½; xiii + 413; 1940.

It is about fifteen years since the University of Chicago first decided to compensate for the long neglect of its undergraduate schools by developing a system that would raise these parts of the University to the prominent rank of its graduate divisions. The result of this decision was the formulation of the "Chicago College Plan," now widely known, but first presented to the faculty in May, 1928, in a report of the progress made by the special faculty committee on the undergraduate colleges. The freshmen entering in September, 1931, were the first students to enroll under the new, or divisional, plan. The first edition of the present book was written and published in 1935 by the dean of the College; it might well be considered another report of progress. The 1940 edition, revised by Dean Boucher's successor, discusses the plan ten years after the initial changes that put it into operation. Dean Brumbaugh's edition is a good presentation of an attractive educational program by a man who is familiar with its operation, and as such it should be worth reading by anyone interested in our modern schools.

THE AUTHOR PUBLISHER PRINTER COMPLEX. *By Robert S. Gill. Williams & Wilkins Co., Baltimore.* $1.00. 7⅛ x 5; iv + 76; 1940.

This handy volume is in no sense a style manual. It gives neither rules for punctuation, nor for grammer, nor does it give "Examples": yet it does contain the essential directions for preparing a manuscript for the printer. Written by one with many years' experience in the publishing business, it gently, and at times with considerable humor, leads the reader through the different stages that printer and author have more or less in common in the process of getting a manuscript before the public. The beginning author, or editor, heeding the invaluable suggestions herein discussed will find this particular part of his work moving along with astonishing ease.

MAKE YOUR PICTURES SING! *How to Perfect Your Technique. By Paul L. Hexter. Camera Craft Publishing Co., San Francisco.* $3.00. 8¾ x 6; 188; 1940.

Written in a manner completely understandable to the amateur photographer, this is one of the best of numerous recent volumes on the subject. It presents many practical suggestions for producing fine photographic results. The principles described are well illustrated, but the book lacks an index.

1940 BRITANNICA BOOK OF THE YEAR. *A Record of the March of Events of 1939. Prepared under the Editorial Direction of Walter Yust. Encyclopaedia Britannica, Inc., Chicago, London and Toronto.* $10.00. 10⅞ x 8⅜; xx + 748; 1940.

A useful record, alphabetically arranged, of events of 1939 in all fields of endeavor and all parts of the world. As in the earlier volumes of these annuals, illustrations, an index, and a calendar of events of the year have been provided.

UNIVERSITY OF COLORADO STUDIES. *Series B. Studies in the Humanities. Vol. 1, No. 2.* Containing: *Aspects of the Relations between Philosophy and Literature*, by Joseph W. Cohen; *Chaucer's Text-book of Astronomy; Johannes de Sacrobosco*, by Walter B. Veazie; *James Thompson in Central City*, by Marjorie L. Reyburn; *Some Notes on the Plays of T. J. Dibdin*, by James Sandoe. *University of Colorado, Boulder.* $1.00. 10 x 6¾; 104; 1940 (paper).

THE PRICES OF BIOLOGICAL BOOKS IN 1940

By MAUD DEWITT PEARL AND RAYMOND PEARL

Department of Biology, School of Hygiene and Public Health, Johns Hopkins University

WHEN the QUARTERLY REVIEW OF BIOLOGY began publication in 1926 the custom was inaugurated of reporting at the end of each volume on the cost of the books that had been reviewed in its columns during the year. The present paper, therefore, is the fifteenth of these reports on the prices of biological books. The prices of foreign books have been converted into dollars on the basis of the exchange at the time the books were received. Table 1 shows the findings for 1940, arranged in the customary manner.

Table 1 shows definitely effects of the impact of World War II upon the scholarly activities of Europe. This accords with the anticipation expressed in last year's report. Already it is clear that the report for 1941 will present a still sadder picture. In 1940 the first evident effect is in the decreased total number of pages of biological books from the belligerent countries reviewed in these columns. The total number of pages reviewed in 1940 is 164,654, a decrease of 14,947 pages or 8.3 percent below 1939. The falling off in material from belligerents was 4,842 pages, or 66.5 percent for Germany; 4,003 pages, or 41.2 percent for France; 3,090 pages, or 18.8 percent for Great Britain; and 1,579 pages, or 10.0 percent for British-American books. These four items together represent a loss of 13,514 pages. Also the U. S. Government publications reviewed in 1940 had 4,194 fewer pages, or 47.0 percent, than those reviewed in 1939 from the same source. To offset these deficits there were increases of only 1,989 pages for U. S. A. books (other than governmental); 452 pages for Other countries; and 320 pages for British Government publications. The changes in prices of books from the belligerent countries will be discussed below.

In the fifteen years of the QUARTERLY REVIEW's history the books reviewed in these columns have aggregated a total of 1,968,919 pages. To American buyers these cost in the aggregate a total of $20,879.34, leading to an average price per page for the total of 1.060 cents. The weighted average cost of 0.959 cents per page for all the books reviewed in 1940 is 10.4 percent lower than that for all the books reviewed in our columns during the preceding fourteen years 1926–1939 inclusive, taken as a bulk total. It is higher than the corresponding average for 1939 of 0.941 cents per page by 1.9 percent. The 1940 average price per page for all books reviewed is 12.6 percent lower than the corresponding figure for 1926, which was 1.097 cents. But the generally accelerating fall in the prices of biological books that began in 1937 and was commented on in last year's report was somewhat checked in 1940, as will appear later in the more detailed analysis presented in Table 2 below.

In 1939 Germany stayed in her cus-

TABLE 1

Prices of biological books, 1940

ORIGIN	TOTAL PAGES	TOTAL COST	PRICES PER PAGE
			cents
Germany	2,547	$56.63	2.22
British American	14,178	179.45	1.27
British Government	1,300	16.19	1.25
Great Britain	13,380	149.29	1.12
Other countries	4,758	51.39	1.08
United States	118,057	1,088.95	0.92
France	5,706	30.45	0.50
U. S. Government	4,728	6.90	0.15
Totals and weighted average, 1940	164,654	1,579.25	0.959
Totals and weighted average, 1926–1939 incl.	1,804,265	19,300.09	1.070

1941 very few, if any, German books for review. Since last June there have been virtually no books coming through to us for review from that source.

Following the custom inaugurated some years ago Table 2 shows the price trends of books published in various countries during the decade from 1931 to 1940 inclusive and the absolute and relative changes in price from 1939 to 1940 and from 1931 to 1940.

The average prices per page of our samples of biological books were *lower* this year than in 1939, from only three sources, namely "Other countries," British Government, and France. The drop was relatively large for "Other countries" (27 percent) and France (15.9 percent). In the case of all the other sources of origin the prices were *higher* in 1940 than in 1939, by amounts ranging from about 2 percent for books commercially produced in the United States to 15.5 percent for the British-American publications. French books continued and enlarged, both absolutely and relatively, the decline in average price per page noted last year.

Over the ten year period from 1931 to 1940 inclusive the average prices per page of the books here reviewed showed a *decline* from every source of origin except

TABLE 2

Comparison of the prices of biological books for the decade from 1931 to 1940

ORIGIN	AVERAGE PRICE PER PAGE										CHANGE + OR − FROM 1939 TO 1940		CHANGE + OR − FROM 1931 TO 1940	
	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	Absolute	Relative	Absolute	Relative
	cents	*cents*	*cents*	*cents*	*cents*	*cents*	*cents*	*cents*	*cents*	*cents*	*cents*	*per cent*	*cents*	*per cent*
British-American	2.27	1.48	1.29	1.45	1.53	1.81	1.44	1.16	1.10	1.27	+0.17	+15.5	−1.00	−44.1
Other countries	1.53	1.02	0.85	0.86	1.20	2.26	0.86	2.18	1.48	1.08	−0.40	−27.0	−0.45	−29.4
Great Britain	1.19	0.89	0.66	0.96	0.84	0.94	1.27	1.04	1.02	1.12	+0.10	+9.8	−0.07	−5.9
United States	1.05	1.00	1.02	0.93	0.90	1.03	0.93	0.96	0.90	0.92	+0.02	+2.2	−0.13	−12.4
Germany	1.75	1.60	1.43	1.89	2.04	1.84	1.95	2.32	2.16	2.22	+0.06	+2.8	+0.47	+26.9
British Government	1.03	1.45	1.39	0.89	0.50	1.62	0.34	0.45	1.30	1.25	−0.05	−3.8	+0.22	+21.4
France	0.69	0.60	0.74	1.00	0.86	1.05	0.85	0.72	0.63	0.53	−0.10	−15.9	−0.16	−23.2
U. S. Government	0.28	0.36	0.17	0.18	0.11	0.21	0.16	0.17	0.14	0.15	+0.01	+7.1	−0.13	−46.4

tomary position at the head of Table 1, as the source of origin of highest prices for biological books. And, in general, all the sources of origin stood this year in about their usual order, except for the dropping of the "Other countries" item from second to fifth place on the list, and some unimportant internal rearrangement of the three British items.

In 1939 the German biological average book prices per page dropped a little from the previous year's level. But in 1940 the average price increased over 1939, by an insignificantly small amount. By present indications we shall have in

two, namely Germany and British Government. These declines ranged from 5.9 percent in the case of books commercially published in Great Britain to 46.4 percent in the case of U. S. Government publications. The United States Government still continues to disseminate scientific information at a price to the consumer well below any other source known to us. American biologists, of course, pay their due share of the taxes that make this beneficence possible, in last analysis. But, in all fairness, it is probable that most of them will feel that the part of their tax dollar that is spent in this way is much more usefully and wisely spent than a lot of the rest of it.

Table 3 sums up the whole fifteen years experience of the QUARTERLY REVIEW. That table has been expanded this year to include a new feature. In the last eight columns of the table the average per page price over 15 years is successively taken as 100 (bold figures) for each source of origin of the books. Then the average prices per page for every other source of origin is expressed in the same column relative to 100. So then it is seen, for example, that over these 15 years covered by the averages for every dollar spent for biological books commercially published in the United States $1.65 had to be spent on the average for biological books published in Germany. And similarly, *mutatis mutandis*, for other comparisons.

It is evident, from what has now grown to be a substantial sample, that during the past fifteen years biological books from all over the world taken together have averaged to cost the American biologist very close to a cent a page, taking good, bad, and indifferent together. Furthermore it is plain that the sources of origin of these books fall into three fairly sharply defined groups relative to unit prices to the American buyer. In the first or relatively high priced group fall books in the British-American, Germany, and "Other countries" categories of origin. The primary reason why the British-American books fall in this category is because they carry an import duty charge, paid on the sheets manufactured in England but issued here by an American branch house. The next or medium priced group includes the United States, British Government, and

TABLE 3

Average biological book prices over the fifteen year period, 1926–1940 inclusive

ORIGIN	TOTAL PAGES	AVERAGE PRICE PER PAGE	RELATIVE AVERAGE PRICE ON BASE 100 FOR							
			U. S. Govt.	France	Brit. Govt.	U. S. A.	Great Brit.	Other Count.	Brit. Amer.	Germany
		cents								
Germany	182,904	1.651	794	241	168	165	160	122	112	**100**
British-American	144,701	1.479	711	216	151	148	143	109	**100**	89
Other countries	61,375	1.354	651	197	138	135	131	**100**	92	82
Great Britain	163,396	1.033	497	151	105	103	**100**	76	70	63
United States	1,192,655	1.001	481	146	102	**100**	97	74	68	61
British Government	11,499	0.982	472	143	**100**	98	95	73	66	59
France	148,267	0.686	330	**100**	70	69	66	51	46	42
U. S. Government	64,122	0.208	**100**	30	21	21	20	15	14	13
Total and weighted average	1,968,919	1.060	—	—	—	—	—	—	—	—

Great Britain (commercial publishers). None of the books in this category carry import duty charges in the prices here tabulated, because in the case of the British books the English prices are used. Actually an American buying these books would have to pay duty. This would then, in fact throw them into the same group as the British-American publications. Finally the third or relatively low price group includes books published in France and by the U. S. Government.

The reader should bear in mind that these reports are based on small samples of books in general and, for some countries, on small samples of the biological books published. He should therefore be cautious in applying conclusions drawn from this material to the general domain of book prices.

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